PARLIAMENTARY FORUM ON GLOBAL CLIMATE CHANGE

Dr. Harry Brightwell, M.P.
Chairman

April 23 and 24, 1990

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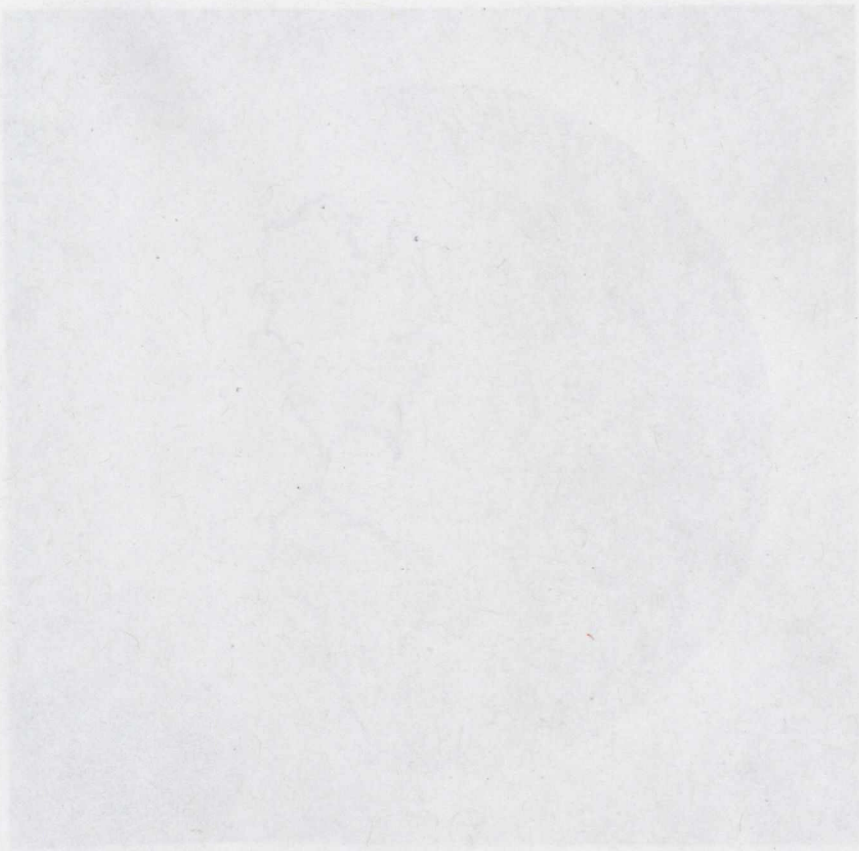
PARLIAMENTARY FORUM
ON
GLOBAL CLIMATE CHANGE



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Chairman

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HOUSE OF COMMONS

Special Issue

Monday, April 23, 1990
Tuesday, April 24, 1990

Chairman: Dr. Harry Brightwell

CHAMBRE DES COMMUNES

Fascicule spécial

Le lundi 23 avril 1990
Le mardi 24 avril 1990

Président: Dr Harry Brightwell

Minutes of Proceedings and Evidence of the Standing Committees on

Procès-verbaux et témoignages des Comités permanents

Agriculture	**de l'Agriculture**
Energy, Mines and Resources	**de l'Énergie, des Mines et des Ressources**
Environment	**de l'Environnement**
Forestry and Fisheries	**des Forêts et des Pêches**
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Industry, Science and Technology, Regional and Northern Development	**de l'Industrie, de la Science et de la Technologie et du Développement régional et du Nord**
Labour, Employment and Immigration	**du Travail, de l'Emploi et de l'Immigration**
Transport	**des Transports**

RESPECTING:

The Parliamentary Forum on Global Climate Change

CONCERNANT:

Le Forum parlementaire sur les changements climatiques dans le monde

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Second Session of the Thirty-fourth Parliament, 1989-90

Deuxième session de la trente-quatrième législature, 1989-1990

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Parliamentary Centre

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Parliamentary Centre

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ORDERS OF REFERENCE

Extract from the Votes and Proceedings of the House of Commons:

Wednesday, March 28, 1990

That, notwithstanding any Standing Order, Standing Committees of the House be empowered to sit together in plenary session and in a series of joint sessions to hold a Parliamentary Forum on Global Climate Change;

That the plenary session be held on Monday, April 23, 1990;

That, notwithstanding Standing Order 115, the joint sessions of Standing Committees be held during periods coinciding with the hours of sitting of the House;

That all questions relating to the organization of the Forum and implementation of this Order be decided by a committee composed of representatives chosen by participating committees, chaired by Dr. Harry Brightwell, M.P.; and

That the Organizational Committee be empowered to print a single, joint record of the proceedings of the Forum.

Friday, March 30, 1990

That, pursuant to the Order of the House made on Wednesday, March 28, 1990, respecting the plenary session and joint sessions of Standing Committees on the subject of global climate change:

- televised broadcasting of the sessions of the Forum be authorized and that such broadcasting be according to established House of Commons principles and practices; and
- the expenses of the Forum be met from the block of funds assigned to the Liaison Committee for Standing Committee activities.

ATTEST

ROBERT MARLEAU

Clerk of the House of Commons

PREFACE

Harry Brightwell, M.P.,
Chairman

Standing Committee on Agriculture

May 1990

The proceedings that follow are a record of the result of a year's work by many people. At the beginning of that year, we saw many committees undertaking studies on environmental issues, and each was calling witnesses who could have been of value to several other committee studies. It was obvious that environmental issues were going to be predominent in this Session.

The idea which evolved into the Forum was that a joint set of hearings would be much more efficient, would allow all committees to begin from the same solid base, and would create enough general interest to emphasize that Parliamentarians are concerned about environmental matters.

The greatest challenge was to communicate to all committees—including my own Standing Committee—the idea and its objective. My clerk, Carmen DePape, with excellent co-operation and encouragement on the part of her superiors, researched the procedural matters. The Library of Parliament added their research on the substantive aspects of climate change. Many people questioned the propriety of the Agriculture Committee's leading in this matter of environmental concern. The answer was that problems in the environment touch everyone; they are not only a concern to environmentalists or to the Environment Committee.

The House Leaders co-operated by accepting House Orders that would permit this unprecedented meeting.

Once you have read the proceedings, I believe you will agree that we have brought together information on this one aspect of environmental concern—climate change—that might be considered a snapshot of the current information and views. I know we have also succeeded in demonstrating Parliamentarians' interest and increasing our awareness of this topic.

In retrospect, I wonder which will prove to be our greatest success: our achievements listed above; the possibility that a similar event could occur annually; or the fact that committees now have a precedent for more efficient functioning.

To all who worked so hard in a manner well beyond normal—including Sonya Dakers and Carmen DePape, the Standing Committee on Agriculture's research co-ordinator and clerk, respectively; my senior staff person, Bonnie Cherryholme; our organizational consultant, Peter Dobell; and many other Hill staff—must go most of the credit and the thanks of participating MPs for a successful Forum.

Harry Brightwell, M.P.,

PARLIAMENTARY FORUM ON GLOBAL CLIMATE CHANGE
April 23–24, 1990

MONDAY, APRIL 23, 1990

10:30–13:00: Opening Plenary Session (Room 253–D, Centre Block)

Opening Addresses

Chair: Dr. Harry Brightwell, M.P.

10:30–10:40: The Hon. John Fraser, P.C., M.P., Speaker of the House.
Introduction to the Forum and Welcoming Remarks.

10:40–11:05: Mr. Alain Giguère, President of CROP Inc. and Mr. Doug Miller, President, Synergistics Consulting Ltd.
Joint Presentation on Changes in Public Attitudes and Perceptions of Global Climate Change and the Role of Government.

11:05–11:30: Dr. Stephen Schneider, National Center for Atmospheric Research.
Statement on the Scientific Dimensions of Climate Change.

11:30–11:55: Dr. Jim MacNeill, Director of The Environment and Sustainable Development Program, Institute for Research on Public Policy.
Statement on the Policy Implications of Climate Change.

12:00–13:00: Question and Answer Period

13:00: Adjourn

15:30–17:30: Joint Committee Session I
Meeting of the House of Commons Standing Committees on Industry, Science and Technology, Regional and Northern Development; Transport; and Energy, Mines and Resources

Chair: Barbara Sparrow, M.P. and Charles Langlois, M.P.

Expert Witnesses:

Dr. Digby McLaren, President, Royal Society of Canada.
An Industry Perspective.

Mr. Michael McNeil, President, Canadian Automobile Association.
A Transportation Perspective.

Dr. Hélène Connor–Lajambe, President, Centre d'Analyse des Politiques énergétiques (CAPE) and member of the National Roundtable on the Environment and the Economy.
An Energy Perspective.

Question and Answer Period

17:30: Adjourn

19:30–21:30: **Joint Committee Session II**
Meeting of the House of Commons Standing Committees on Forestry and Fisheries; and Agriculture

Chair: Dr. Charles-Eugène Marin, M.P.

Expert Witnesses:

Dr. Jean Boulva, Director, Maurice Lamontagne Institute, Fisheries and Oceans.
A Fisheries Perspective.

Dr. Jag Maini, Assistant Deputy Minister for Policy, Forestry Canada.
A Forestry Perspective.

Ms. Elaine E. Wheaton, Lead Scientist, Climatology Section, Saskatchewan Research Council.
An Agricultural Perspective.

Question and Answer Period

21:30: Adjourn

TUESDAY, APRIL 24, 1990

9:45–11:45: **Joint Committee Session III**
Meeting of the House of Commons Standing Committees on Labour, Employment and Immigration; Health and Welfare, Social Affairs, Seniors and the Status of Women; and Environment

Chair: Mr. Jean-Pierre Blackburn, M.P.

Expert Witnesses:

Dr. Louise Arthur, Professor, Department of Agricultural Economics and Farm Management, University of Manitoba.
A Labour Perspective.

Dr. David Bates, Professor Emeritus of Medicine, Department of Health Care and Epidemiology, University of British Columbia.
A Health Perspective.

Mr. David Runnalls, Associate Director, Environment and Sustainable Development, Institute for Research on Public Policy.
A Concluding Commentary.

Question and Answer Period

12:00–13:00: **Closing Plenary Session**

Chair: Mr. Harry Brightwell, M.P.

Closing Address: The Hon. Lucien Bouchard, P.C., M.P.,
Minister of the Environment

OPENING PLENARY SESSION

Agriculture

Energy, Mines and Resources

Environment

Forestry and Fisheries

Health and Welfare, Social Affairs,
Seniors and the Status of Women

Industry, Science and Technology,
Regional and Northern Development

Labour, Employment and Immigration

Transport

EVIDENCE

[*Recorded by Electronic Apparatus*]

Monday, April 23, 1990

.1034

The Chairman: Ladies and gentlemen, I would like to begin this session pursuant to the special order of the House that was passed on March 28 and 29, 1990, to call to order this plenary session of a parliamentary forum on global climate change.

.1035

There are only two points of order this morning. We are live; we are going out on the parliamentary channel. This was decided only last Friday. It is something new; we had thought we would be in a replay situation. Therefore, the end of the session will be at 12.55 p.m., rather than 1 p.m., as your program might say.

The speakers all seem to have enough material for the 25 minutes we have allotted them, plus a bit more. We are going to work on 30–minute sessions for the morning, rather than 25–minute sessions. At the end of the speeches of the three people delivering papers, I will ask for questions from the committee members.

This day is possible only through the co–operation of many people, not the least of whom was the Speaker, who was encouraging and helpful throughout the whole procedure. Perhaps I will wait just a minute before I put the Speaker on the floor, until I thank the other people who co–operated as well.

The eight standing committees of the House came together to create this unique thing of a joint session, which has never been done before, to create an efficiency in our parliamentary system, where we have speakers speaking on a common topic, and on which we can all use the information. In another setting, each committee would bring in speakers, who would then go home. The rest of the committees would not see them. This is what I believe is a very efficient way to do that.

I am pleased the committees have worked in this particular way. I am pleased as well with the extraordinary work that has gone into it. There is so much work to this day. Had we known it was here before, we might not have started on it. My staff and my office, my clerk, Carmen DePape, and Sonya Dakers, worked very hard on this issue, as did the clerks and researchers for every other committee as well.

I want to say at the outset that I know the problems of the environment will not totally be addressed here today. It is a much broader issue than global climate change, probably water, probably acid rain, and more immediate problems, but the global changes will be the problem in the long term, I am sure. There are those who do not believe the issue is as important as what I believe or what I am sure all of us here at the table believe it to be. There are some who believe that in Canada global warming will be an advantage for us, not

a disadvantage. However, I expect the experts who are here to put this in the proper perspective, and we have indeed asked them to do so.

We planned this event to be efficient. We planned this event to raise the awareness of all Members of Parliament regarding the issues of the environment. We planned it as well to demonstrate to Canadians our concern. In planning it, we realized we could give them a textbook on the current situation in the area of global climate change. Through videos of this day and a special proceeding, we will indeed have that textbook available for anybody who wishes it in Canada—I must say subject to supply, I suppose—on the proceedings standpoint.

I know that each of you realize we live in a world with limited ability to recover from the way we use its resources. Around the world today, we are all moving towards making better use of our resources in a way more friendly to the earth.

I am delighted at this moment to call upon a gentleman who has been around this House since 1972, a very experienced parliamentarian, a person who has been a minister of the Crown on two occasions, a person who has developed a great reputation for his particular concern about the environment. I am going to ask this person, the Hon. John Fraser, Speaker of the House of Commons, to now address us and to officially open this forum. Mr. Speaker.

.1040

Hon. John Fraser (Speaker of the House of Commons): Dr. Brightwell, Dear colleagues and distinguished guests, it gives me great pleasure to be able to speak to this Committee especially about environment.

It is first necessary to congratulate each and every one of those who helped make this day possible. The subject at hand is a very important one, but it represents only a part of our task. It is important to note that for the first time, we are seeing many committees of the House of Commons united to discuss a very urgent matter. I must also hasten to add that this day would not have been possible without the cooperation of all parties of the House of Commons and of all members of all political stripes.

It gives me great pleasure to show the Canadian public that sometimes it is possible to foster in the House of Commons a spirit of cooperation among all Members of Parliament who are now very conscious of the urgency of the problem not only for our country but for the whole planet.

The subject you are going to discuss, global climate change, is an emergent subject, as I have said. Of course it is one of the urgent subjects we have to address if we are going to reverse the environmental onslaught that we ourselves have visited upon this planet. After all, especially those of us from the developed countries who have benefited enormously from the industrial revolution, there has been a cost in that revolution that has not been taken into account until probably now.

Who can say why this is? Partly because we did not think it necessary to take into account the cost of the exploitation of our natural resources. It seemed to be free. We thought the air was free, we thought the water was free and we thought the soil was free. We now know that this is not so. One of the reasons we know it is that modern technology and modern science has been able in the last quarter of a century to start to measure just how appalling the damage is.

.1045

Some of you have heard me make these remarks before. I could go through with you a litany of all the difficulties we have to face. We could start with global change, but we would not end there; we would go to ozone depletion, toxic waste, desertification, deforestation, organic garbage disposal and a host of other matters.

I could and I am sure some of you could give a list, a litany of these terrible woes, and that is where too often when we are dealing with environmental matters we leave the issue. You see, it is not good enough just to say what is wrong. We have also to talk about what can be done about it, because if all we discuss are the problems we leave an audience in dismay.

When Churchill was faced with the terrible decision as to whether or not to go ahead with the great artificial harbour that had to be towed across the Atlantic for the landings in France, his advisers got up and started to list the difficulties. He said "Do not speak to me of the difficulties; they will speak for themselves". It is the same with the environmental problem.

What we have to do is think about what resources have we to do something about it. For starters, we have information that we never had before. We know more about what has gone wrong than any generation. There is more knowledge, scientific, techonological, sociological, economic and financial in the world today than there has ever been. We are by nature an extraordinarily adaptable beast, or we probably would not have lasted this long. Our capacity to adapt, to change, to fundamentally adjust our attitudes and our approaches, is something that is the genius of the human race, and we will have to call upon it to be used.

We also have leadership, which is something that is probably as important in this issue as it has ever been in the history of the human race. We are going to have to change. We have the capacity to change, but we must have leaders who will say that we must change.

It has been said, and I have said it, that we are the first generation in the history of the human race that looking down on coming decades can clearly see that if we do not change we shall not survive, at least as we survive today.

There is a great temptation to look at these problems and say that it is somebody else's problem, or that it is worse somewhere else. There is a great temptation to say that in this country alone we cannot do anything about it, that the global situation is too great. This sometimes is greeted with concern, but there is nothing particularly new about it. There has always been a tendency for us not to want to look at the wide world, to take comfort in our own little world.

It comes out in interesting ways in literature. Some of you, I hope many of you, will remember a marvellous book that was written for children and has been read by adults ever since. It is called *The Wind and the Willows* by Kenneth Grahame. You will remember that charming, charming story of all the little animals along the river and in the meadows and in the copses, and even in the wild wood. There is a section I saw the other day when I was rereading it. Mr. Mole was speaking to Mr. Rat, and he asked this question:

> "And beyond the Wild Wood again?" he asked. "Where it is all blue and dim and one sees what may be hills, or perhaps they mayn't, and suddenly like the smoke of towns, or is it only cloud drift?"
>
> "Beyond the Wild Wood comes the Wide World", said the Rat, "and that's something that doesn't matter, either to you or me. I've never been there, and I'm never going, nor you either, if you've got any sense at all. Don't ever refer to it again, please. Now then! Here is our backwater at last, where we are going to lunch".

You see what that little passage says about us today when we say we cannot do anything about it here and we certainly do not want to go out into the wide world and do anything about it.

.1050

This theme was exhibited by Thoreau in *Walden*. You can find it again in John Buchan, Lord Tweedsmuir, who wrote *Always a Countryman*, and you will see it again, although with much wisdom, in Bruce Hutchison's beautiful book, *A Life in the Country*. So if we have this tendency to say we do not want to look out into that wide world and all the terrible things we may see, there is nothing new about it. There has always been a haunting sense of trying to stay within our own comfortable back yard and to let the wide world go. But we cannot do that, and it is a factor of leadership that our leaders make sure we understand we do have environmental terms to go out in the wide world.

None of us is here all by ourselves. We are all part of total humanity; we are also part of the globe. We are part of all living creatures; we are just another one of them. This was said evocatively and has been repeated many times since John Donne first wrote it toward the end of the 1500s:

No man is an island, entire of itself; every man is a piece of the continent, a part of the main; if a clod be washed away by the sea, Europe is the less, as well as if a promontory were, as well as if a manor of thy friends or of thine own were; any man's death diminishes me, because I am involved in mankind; and therefore never send to know for whom the bell tolls; it tolls for thee.

My friends, we got into this great difficulty together and we shall have to get out of it together. I thank you for being here; I wish you well. God bless you all.

The Chairman: Do we have translation? I do not think we do. I apologize that the francophones do not have that service.

We have with us today a gentleman who has come from New York City. In 1969 he voiced the first suggestion of an Earth Day. He does not receive recognition for that, but in 1969 he voiced an opinion and obtained some agreement on that in events in San Francisco, went through the United Nations, and got support from Margaret Mead. I am delighted this gentleman has chosen to visit us today, and I want to take a moment to recognize him. I would like you to greet John MacLellan, of New York City. John, stand up. John of course has spent all of his time holding Earth Days since 1969.

I will move ahead with the next part of the program. I did say we were going to work on 30-minute intervals. We have speakers coming to us in a team, this time from a polling standpoint, to tell us what Canadians think about the climate and what public opinion is.

We have Mr. Alain Giguère, President of CROP, Inc., a research centre on public opinion, and Mr. Doug Miller, President of Synergistics Consulting Ltd. They will give a joint presentation.

.1055

Alain has a bachelor's degree from the University of Quebec in Montreal, and a master's degree in demography from the University of Montreal. He has taught research methodology at the University of Quebec in Montreal for a number of years. Alain will begin the presentation.

I would introduce Mr. Miller as well, because he will follow along and they will run their own show after I am done here. Mr. Miller has been active in environmental issues and public education in Canada for the past 15 years. He has developed, implemented, and evaluated a large number of successful communications and public education programs. He directs the Environmental Monitor, Canada's only syndicated public opinion survey, focusing exclusively on environmental and resource issues. I apologize to Mr. Miller that in the English version of the program there is a small part of that background information missing.

Mr. Giguère, I believe you wish to start.

Mr. Alain Giguère (President, CROP Inc.): Mr. Speaker, Mr. Chairman, ladies and gentlemen.

Mr. Miller and I are happy to have this opportunity to present to you this morning information about the state of public opinion in Canada with respect to the environment.

I imagine it will be no news to you to hear that the environment has now become the major concern of Canadian public opinion at the present time; CROP Inc., our research institute, has been measuring public opinion for 25 years and we have observed in the course of the 80s' that this environmental concern has been very quickly coming to the forefront.

I shall try to explain to you some of the reasons why environmental concerns have become so important among Canadians. I will be providing you with some general figures

relating to public opinion and Mr. Miller will enter into a more detailed consideration of the environmental data.

If Canadians show great concern today for environmental matters, it is largely because of fundamental changes in their scale of values.

The Canadian society has evolved; it has undergone a number of basic socio-cultural changes, over the past 20 years and now shows a greater environmental awareness. Many things are being said about the environment today, and are very similar to the comments made 20, 15 or 10 years ago. What has changed is the seriousness of these environmental problems, on the one hand, as well as the attitude of public opinion. The same problems that were explained to public opinion 20 years ago and were not perceived as credible are now taken very seriously by public opinion, 20 years later.

Generally speaking, it is because of the changing values of Canadians that such an awareness has developped. The first important figure I want to show concerns the evolution of the general awareness to this basic issue.

One of the questions regularly asked in our surveys is what is the most important issue facing Canada at the present time? In the 70s', for example, the great majority of Canadians answered inflation. At the beginning of the 80s', I think it was up to 60% of the respondents who stated that the most important issue facing them was unemployment. We have seen the concern for the environment in Canada evolve from almost insignificant to the most important issue. People used to answer that the environment was an important problem for Canada but very few identified it as the major issue for the country at that time.

During the 80s', this concern evolved from almost nothing to about 20%, as indicated in our most recent data of October 1989. This was the spontaneous answer given by 20% of the Canadian population. I want to emphasize the significance of this figure because it was what we refer to in our jargon as an open question. When we put this type of question, we do not suggest any answer. We ask people what they consider to be the most important issue and 20% of our respondents stated that it was the environment. That indicates a basic concern.

Another figure, unfortunately I do not have the slide with me, showing the response to the question: Would you be willing to pay a significantly higher price for environmentally-friendly goods? In June 1989, 85% of Canadians responded in the affirmative to this question, indicating their willingness to pay a higher price for environmentally-friendly products.

I mentioned that this new concern for the environment was linked to the emergence of new values in the Canadian population. These values appeared at the beginning of the 70s' and developed rapidly during the 80s'.

One of the slides points to the development of a more critical attitude among Canadians. As you probably remember, the beginning of the 70s' saw the appearance of a

number of protest groups with students and young people, particularly the baby-boom generation, attempting to impose these new values, not only in Canada but throughout the Western world.

In the 80s' we observed the progressive expansion of these new and critical values throughout the Canadian population. Values such as the rejection of authority and sexism, for example. Canadians have developed far more critical attitudes towards society in general. And because of this more critical stance, the problems relating to the environment and pollution were perceived as sub-products of society. Being more critical towards society in general, they also became more critical about the environment.

Another basic point is the growing concern with quality of life. And health, as one of the basic indicators of quality of life, became an extremely important subject of concern. The figures I am showing you now indicate the degree of importance; 88% of Canadians believe that public health has been affected by pollution; 49% believe that their personal health has been affected by pollution; 73% believe that pollution is a major cause of cancer; and 81% of Canadians believe that pollution problems threaten the survival of mankind. These figures speak for themselves and show how people's concern for quality of life underlies their preoccupation with respect to the environment.

Another fundamental value we have seen develop among Canadians is what we call a "new emotional connection". The perception that the survival of the planet is at risk along with the survival of certain species makes this an emotional issue for Canadians. And we have seen the development of what we describe as a "new emotional connection with the planet". People are emotionally affected by the perceived threat to the planet and are thus sensitized to the need to protect the environment.

A new social consciousness is also developing among Canadians. In Canada the environment is becoming the rallying point for a new social consciousness. This can be noted throughout the country when we ask questions like: Are you willing to do something to protect the environment? Are you willing to make a contribution yourself by recycling or paying more for products? A very high proportion of Canadians, and the numbers are quickly increasing, give signs of having a highly-developed social consciousness, and one of the effects is to make them more sensitive to the need to protect the environment.

We have also been able to measure a growing sense of insecurity among Canadians. The other values I referred to have been developing throughout the 80s'.

This growing insecurity has manifested itself in various forms for about two years now. Canadian public opinion reflects it very vividly. Problems with the economy, the environment give the feeling to the Canadian population that its very way of life is threatened. It is extremely unsettling for most people.

The media dwells on the numerous environmental catastrophies. Pollution has become synonymous with health problems in the mind of Canadians. All those factors

together contribute to create a very uneasy feeling among the Canadian population and make it very aware of the need to protect the environment.

This sociocultural evolution, then, makes everybody sensitive to problems. As I was saying, 80% of the population is ready to pay for environmentally-sound products. And this new philosophy is well entrenched now that it cannot be dismissed simply as a fad. Canadians have become extremely sensitive to the need to protect the environment and they will continue to pay the utmost attention to the problem.

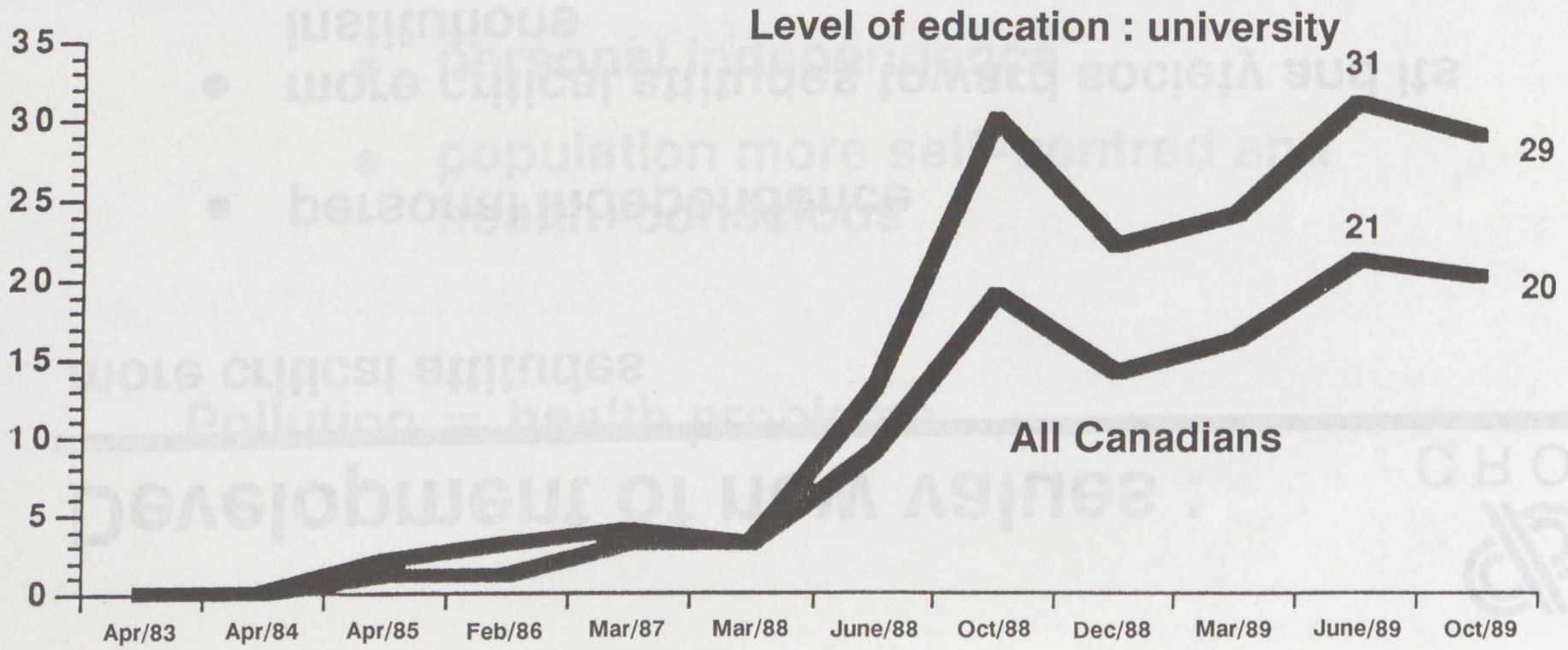
Now, for more precise data on the attitude of Canadians regarding global warming, I defer to Mr. Miller.

Thank you.

The most important problem : The Environment

CROP

1983 - 1989



Development of new values :

CROP

more critical attitudes

- **personal independence**
- **more critical attitudes toward society and its institutions**

more critical about environmental pollution.

CROP

More self–centred

- personal independence
- population more self–centred and health–conscious

Pollution = health problems

CROP

Environment and health

88%	of Canadians believe that the health of the general public has already been affected by pollution
49%	believe that their own health has been affected
73%	believe that pollution is one of the main causes of cancer today
81%	believe that pollution problems threaten the survival of the human race.

November 1989, The Environmental Monitor

CROP

An "Emotional connection"

- People more aware of their emotions
- New "emotional connection" with the environment

(+ in Quebec, among Francophones)

CROP

Social awareness

- Development of a new social awareness, a new sense of duty
- Each of us must do something to protect the future

(+ in English Canada)

CROP

Growing insecurity

- Insecurity widespread in the population: economy and environment
- Catastrophes reported by the media
- Pollution = Health problems
- Growing insecurity related to the pollution problem

Mr. Doug Miller (President, Synergistics Consulting Ltd.): Good morning, Mr. Speaker, Mr. Chairman, ladies and gentlemen.

My colleague's first slide showed the dramatic rise of environment as a top-of-mind issue in Canada over the last two and a half years. Over this same time, the environmental monitor has conducted 10 surveys every three months with a random sample of 1,500 Canadians just on environmental and resource issues. I can say that the results of our research fully substantiate the strength of conclusions that my colleague has drawn from his values-based research.

The two key things that we see are first that the environment has been broken into two distinct issues in the minds of Canadians. One is that it is a planetary survival issue, having supplanted the fear of nuclear war as the greatest threat to planetary survival in the minds of Canadians. Secondly, it is a personal health issue, an issue that, given their perceptions of the degree of contamination of their immediate environment, of the air they breathe, of the water they drink, of the food they eat, they believe that their health is being personally threatened, as you saw quite forcefully in the results Mr. Giguère showed.

Today, the personal health component of the issue is the one that is foremost in the public mind. It is the one that they want action on immediately. The bundle of issues that relate to that is where they are putting their priority. However, the planetary survival questions that are so linked to the atmospheric issues that we are dealing with today in this parliamentary forum are increasingly taking public attention, and their concerns are being raised.

All of this is putting tremendous pressure on the institutions of government and commerce in this country. I thought that before focusing on the specific issues being addressed I would show a few slides that indicate the extent of this focus.

Just who do Canadians hold responsible for environmental protection? This slide shows results of the same question asked two years apart—in 1987, the blue, and just this last fall in the green. It allocates resposibility. You can see that 3 in 10 Canadians assign primary responsibility to the federal government for environmental protection. Immediately following that, however, they assign primary responsibility for environmental protection to individual Canadians. You can see that this has increased somewhat in the last two years.

Increasingly, Canadians are recognizing that they have a share of this responsibility. However, they are looking to the federal government for some leadership on this issue. Those legislators in the room will notice that way down at the end of the chart are provincial governments, where only 5% of Canadians assign primary responsibility for the environment to provincial governments.

.1110

As you know, in Canada under our Constitution the jurisdictional break-outs are predominantly provincial in terms of the environment and that the federal government has

relatively limited powers under the Constitution to address the environment. So herein lies a tremendous difference in expectations vis–à–vis the jurisdictional base, and that no doubt will cause you some heartburn.

This is not saying that Canadians are looking to the federal government to do it. It is clear from quite a lot of different questions that Canadians are looking to the federal government for leadership of a collective action that involves everyone, including individual Canadians, provinces, and industry.

Okay, if that is who Canadians assign responsibility to, how do they feel they are doing? We have an environmental report card which shows for three years running answers to a question. We asked Canadians, how well are each of these actors doing? Are they doing an excellent, good, fair, or poor job? This chart shows poor performance ratings only, and not unexpectedly we see at the top of the chart that private industry is seen by one out of two Canadians as doing a poor job on environmental protection. But you can see that over the three years of our research this criticism has not really grown very much, unlike virtually every other actor on this chart.

The next–worst environmental performer in the minds of Canadians is the federal government, with four in ten Canadians, 42%, saying that the federal government is doing a poor job on environmental protection. You can see that over the last three years this number has doubled, from a base of 20% in 1987. But the federal government also has not been particularly singled out. If you skip one and look at provincial governments, you can see a tremendous surge in criticism of provincial governments as well, and indeed, next, the municipal governments.

Canadians are increasingly critical of governments: 83% of Canadians say that governments in Canada seem unable to come to grips with our environmental concerns. However, note the way they have assigned increasing responsibilities to themselves. Here you see that they are also increasingly critical of the role that individual Canadians are playing on this issue and they are not pointing the finger at governments. They recognize that they also have to do better. However, they are looking to government for leadership.

The political implications of this are quite obvious. The U.S. pollster Lewis Harris did a landmark 14–nation poll for the United Nations Environment Program. Because of the strength of feelings on the environment that he found in developed and developing countries, he concluded that a number of political leaders were probably going to lose their jobs because of inaction on the environment.

One indicator of the strength of feelings that people have is their willingness to pay more for environmental protection. This next slide shows the results of this 14–nation survey that the United Nations did. It shows that countries like Nigeria, India, Mexico, Norway, and the United States, in those countries 8 out of 10 citizens are at least somewhat willing to pay increased taxes for environmental protection. Perhaps most significant is the United States, a nation not known for its love affair with the taxman.

Unfortunately, Canada was not included in this research. However, we have superimposed on these findings results from our own survey work of a related question, to show you that Canada is towards the leading edge of concern and willingness to pay. Only 15% of Canadians are unwilling to pay more for environmental protection, and 42% identify a surtax on personal income tax as their preferred mechanism.

.1115

That is one indicator. We also find that Canadians are increasingly expecting major change in their own lifestyles. We asked them:

To what extent do you think the way that we as individual Canadians live will have to change in order to take a more environmentally sustainable track?

You can see that 51% of Canadians expect major change in the way they live, in their lifestyle; 4 in 10 identify that moderate change is coming. These are significant findings.

To conclude this section, Canadians expect major changes to come, they are willing to play their part, and they are looking to government—the federal government in particular—for leadership.

Let us take a look at the issues before us today. Where do they sit in the priorities of Canadians, in terms of environmental concerns? This chart shows all the issues we ask Canadians every year as to how concerned they are.

As I was saying earlier, all health-related issues are at the top of the chart. These relate to toxic chemicals, water quality, air quality, acid rain. All of these are linked to personal health concerns. Three-quarters of Canadians are very concerned about these issues.

In the next tier of issues—the intermediate tier—we see ozone depletion showing up. You can see that it has increased significantly in the last year, up to 64% from 58%. We then have to go quite far down to see climate change, second from the end, as a concern. It has not grown over the last year. This is saying that there are other issues higher on Canadians' priority lists.

But when we then go on to ask "In terms of human health, which of these issues most concerns you?"—which is open-ended, we just ask Canadians to respond—2 in 10 identify air pollution as the issue that most concerns them from a human health standpoint. Next comes acid rain, and then other issues down from there.

What we are finding from our research in many questions that we ask is that Canadians are rolling all of these atmospheric issues into a ball of concern in their minds. It is of significant concern for a number of reasons.

They know this environmental sink, if you will, is of most concern, because they know they cannot really avoid breathing it. They can maybe get some water filters and bottled water for their water, and choose food more carefully, but they have to breathe the air.

This is one concern. The other concern is the global nature. Concerning ozone depletion and global warming due to the greenhouse effect, we asked Canadians "Which is

the more serious concern?" Six in ten Canadians identify ozone depletion as the more serious of these two issues. Two in ten identify the greenhouse effect as the most serious of the two.

When we delve behind that and get a sense of what people are really saying, we find that 50% of Canadians are aware of the link between ozone depletion and skin cancer and other cancers; hence, this is very much a human health issue. It is very salient to them; hence, they are choosing ozone depletion over greenhouse effect.

On the greenhouse effect side, we find from our research that 3 in 10 Canadians actually believe global warming is going to be positive for Canada. There are going to be warmer winters, we are going to be able to grow more food—these are the reasons they give us in open-ended responses. So in terms of the public, there is a perceptual barrier here to serious efforts on global warming.

After this, we find a great deal of confusion among Canadians when we go into more depth on these issues. For example, when we ask them: "What is the primary cause of ozone depletion?", we find that 3 in 10 point to just pollution and air pollution generally, in an unspecified kind of way; 20% point to aerosol spray cans—which indeed historically have been a contributor, but now due to product reformulation are not; and you have to go well down to CFCs mentioned by 12%, which are open-ended responses and they have to come up with these, down to coolants and refrigerants identified by 3%.

.1120

Essentially, only one in three Canadians can point to a cause supported by the science base as a specific cause of ozone depletion. We see the similar thing on the greenhouse effect. You ask what are the primary causes. We give them some specific ones to choose from. We find that four in ten actually choose ozone depletion as the primary cause of the greenhouse effect. It is muddled; it is confused in the public mind.

Air-borne pollution generally is identified by 17%, down from 21% a year ago. Significantly up from a a year ago is the loss of forests. This includes both tropical rain forests and domestic forests, and that is a significant jump. This is particularly true in Quebec. There has been a very significant rise in the loss of forests being identified as the cause of global warming.

Burning of fossil fuels is up a little bit, but it is still one in ten Canadians who actually draw that link.

Two things are clear from this research, one of which is there is a lot of confusion about these issues, they are all rolled up. They are very concerned about them, but for the progress of appropriate public policy there is clearly a tremendous need for public education. This kind of awareness and understanding of the issues is not going to support appropriate public policy, let alone support the kind of actions that Canadians are clearly identifying they are willing to take to help the situation. Today, six in ten Canadians say that they have

changed their purchasing behaviour due to their concerns for the environment. They are willing to do their part. They have not been given the information and the understanding on this issue in order to play their part in it. Who is going to give that to them? Who can best do that public education?

One of the questions we ask is this: Who do you find most credible as a source of information on the environment? Again, they are two years apart—1987 and currently. Independent science and experts are identified, first and foremost, with 50% of Canadians saying that they have a great deal of confidence in the environmental information they get from independent scientists and experts. Four in ten Canadians express a similar level of confidence in the information they get from environmental groups. Next comes television and newspapers; then comes a tier of government ministries responsible for this. You can see in keeping with the increased criticism we showed earlier of government efforts, the credibility of these departments and ministries has similarly declined. At the end, ministry leaders and politicians are given very poor confidence from Canadians. The credibility is not there, for this kind of information.

What this is saying is that scientists and certainly environmental organizations are playing an active role in public education in Canada today. They are viewed very favourably and very credibly by a majority of Canadians. They are active in public education. They can no doubt extend their efforts with more resources.

Noticeable by their absence perhaps are independent scientists and experts. Clearly they have played an active role and have done conferences and fora like this, but in terms of the professional associations involved in taking on public education as a concerted effort to try new ways of reaching people, they are noticeable by their absence. On a complex issue like this, our research suggested that there is a tremendous opportunity for them to play a valuable role in Canada and elsewhere.

I am going to leave you with the slide my colleague Mr. Giguère started with, which is the rise of this issue of the environment. That light blue line is the university-educated Canadians, where it is a much more salient issue.

I wanted to point to this, because essentially I have been saying that intellectually Canadians do not feel that global warming per se is one of their top priorities. When we asked them a whole line of questions, that does not come near the top. However, I think this chart shows the potency of the global warming issue. I would point to the fact that the most rapid rise of top-of-mind concern for the environment, shown on this chart, occurs during and immediately following the summer of 1988.

.1125

I would like you to think back to that summer, which was extremely hot and dry: a dustbowl situation occurred on the Prairies, a conference on global warming took place in Toronto, and it was the first time the issue of climate change came fundamentally and powerfully into the minds of Canadians. I am not here to say the summer was the reason for

that sharp increase, but I would suggest it was a catalytic agent for all those health concerns we had been tracking during the previous decade. We were waiting for something to act as a catalyst to forcefully bring the issue in front of Canadians and one of the prime catalysts during that summer was global warming.

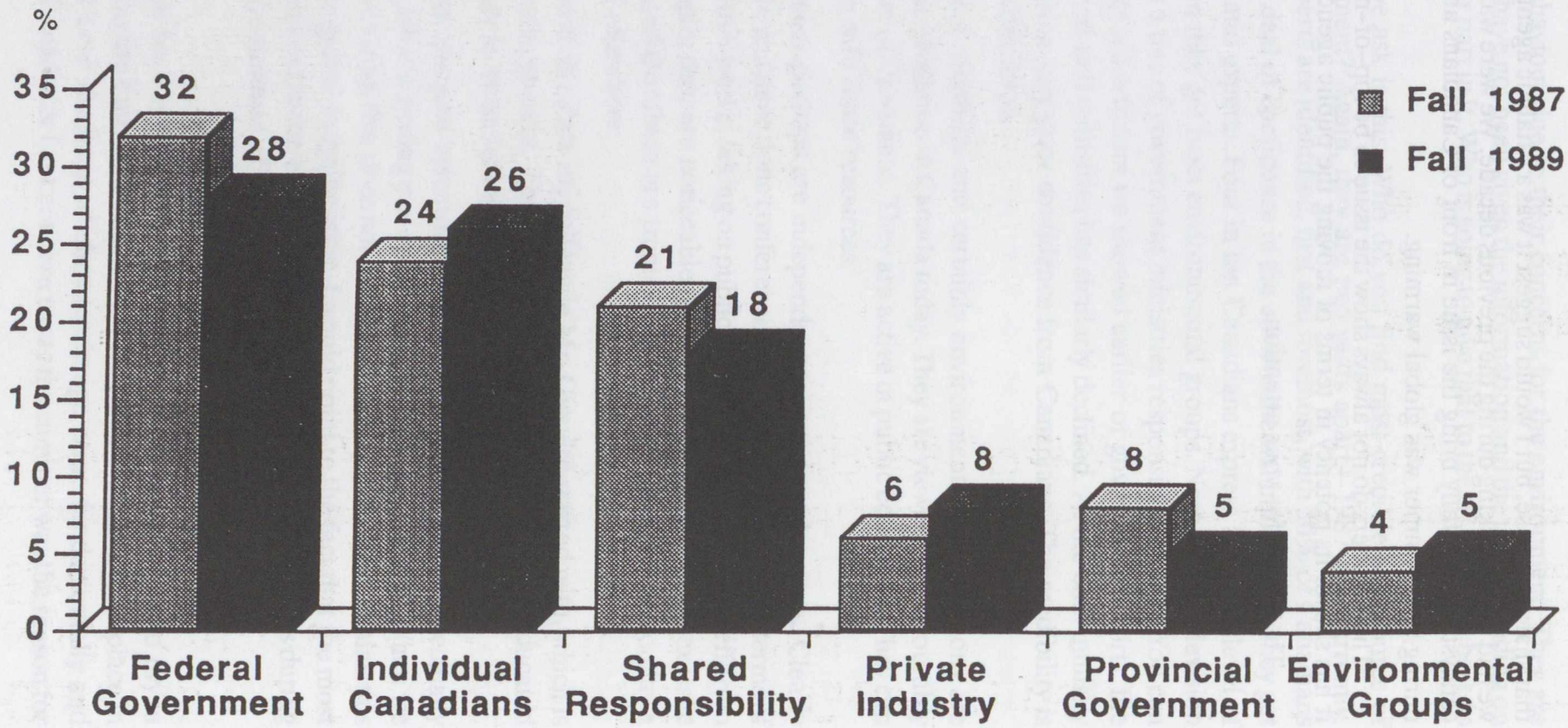
The numbers do not always show the issue to be top–of–mind and most important, but it has shown its potency in terms of moving the public agenda.

Thank you for your attention.

Canadians Hold Everyone Responsible But Look to the Federal Government for Leadership

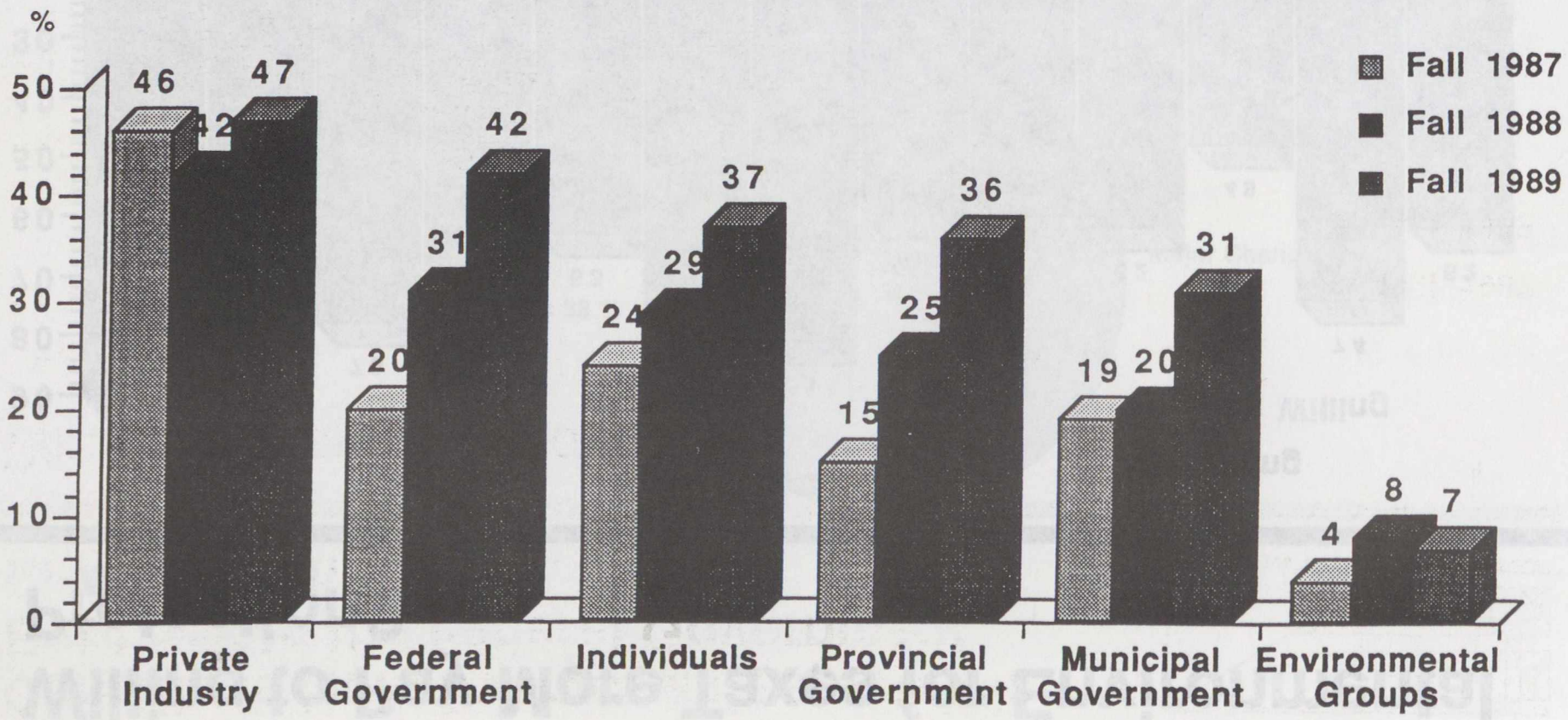
The Environmental Monitor™

Who is Primarily Responsible?

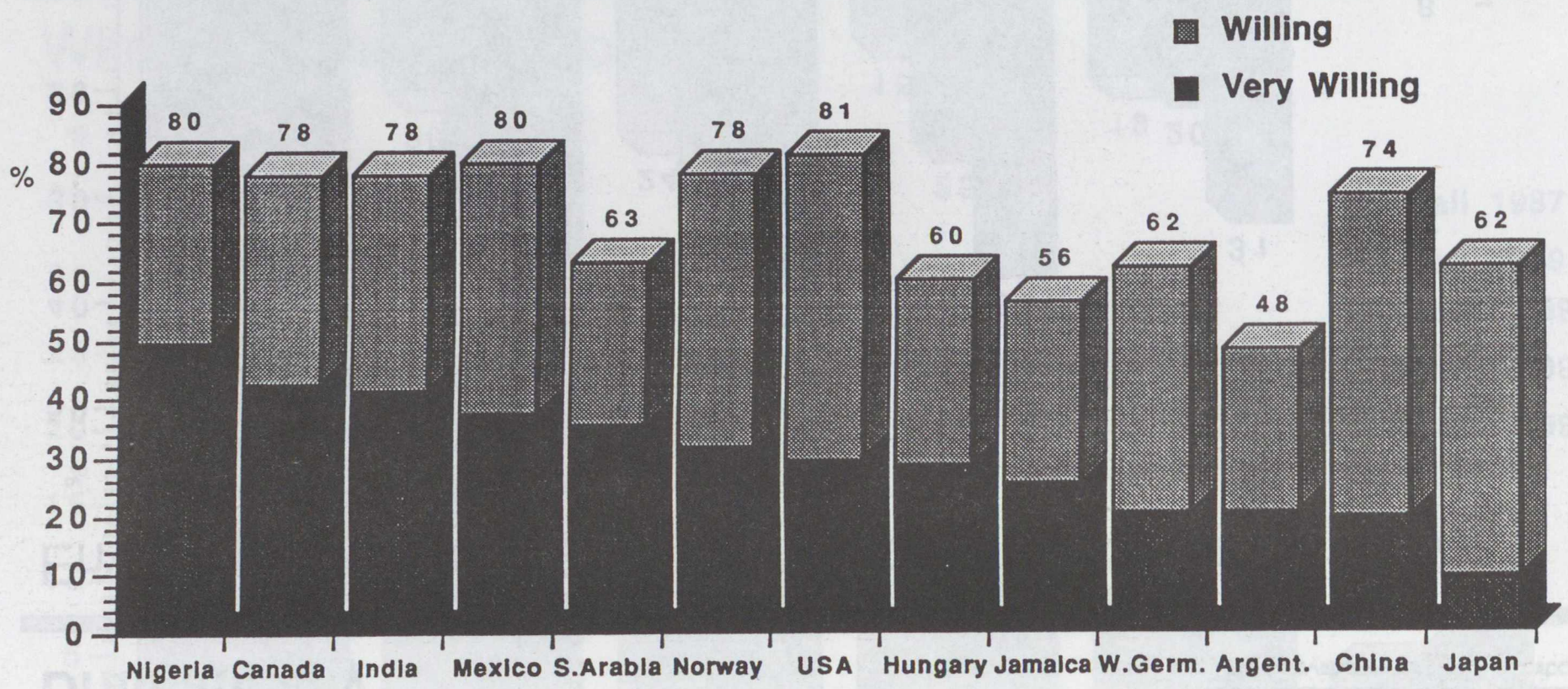


Canadians' Criticism of Their Governments and Themselves Has Increased Dramatically

The Environmental Monitor™



Willing to Pay More Taxes for Environmental Protection?

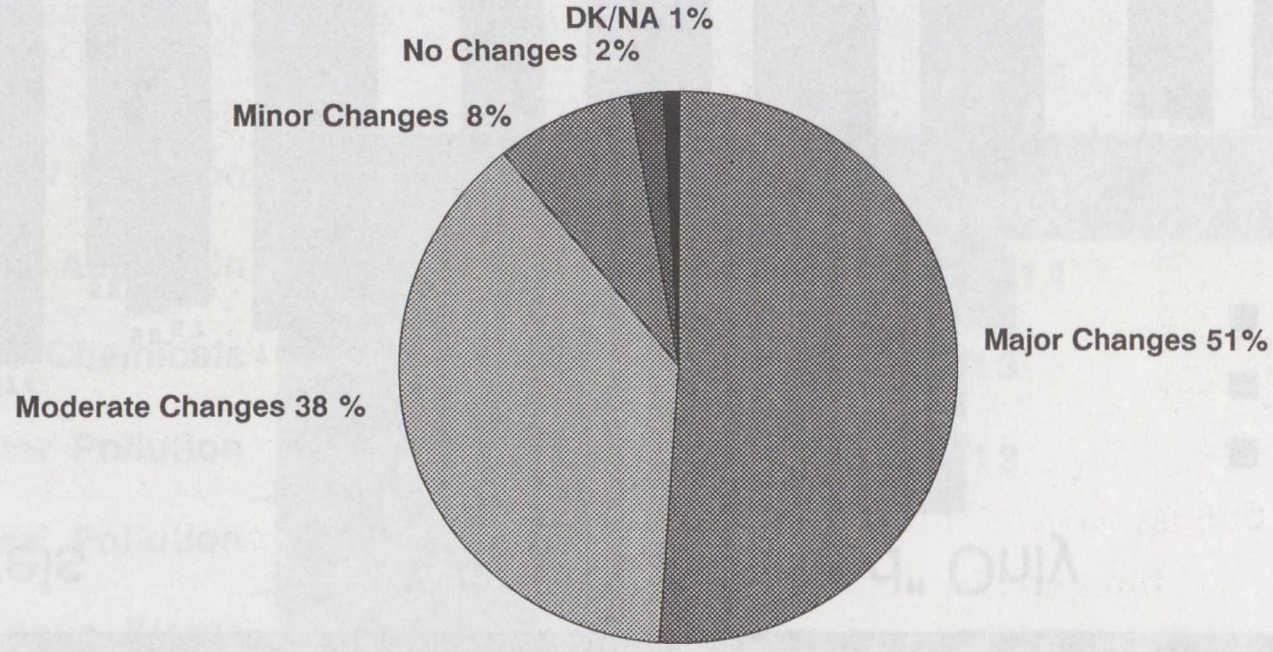


Source: UNEP (1988) Survey by Louis Harris
The Environmental Monitor (1989)

Canadians Expect Major Lifestyle Changes Will be Needed

The Environmental Monitor™

TO ACHIEVE SUSTAINABLE DEVELOPMENT

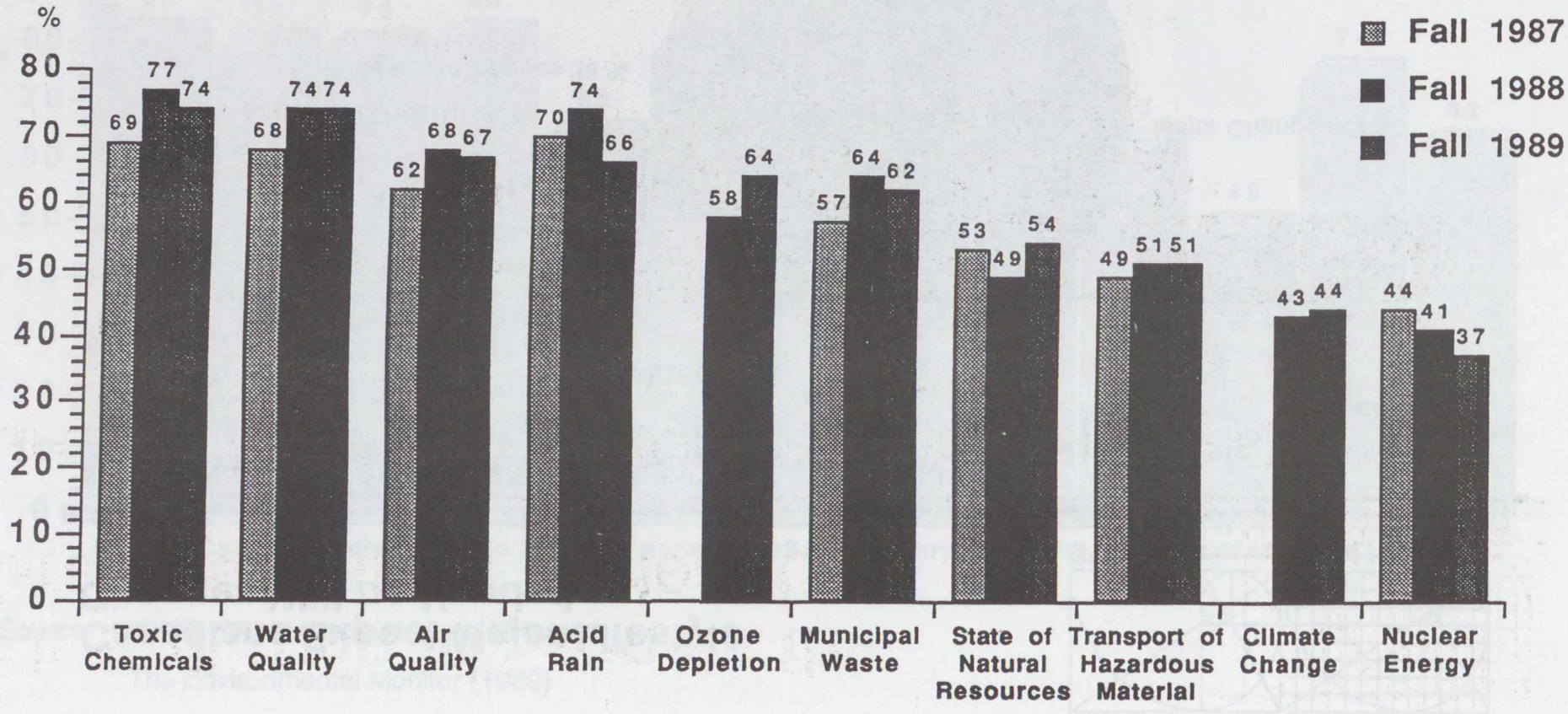


Winter 1990

Concern Remains High for Specific Environmental Issues, Especially for Chemicals and Water Quality

The Environmental Monitor™

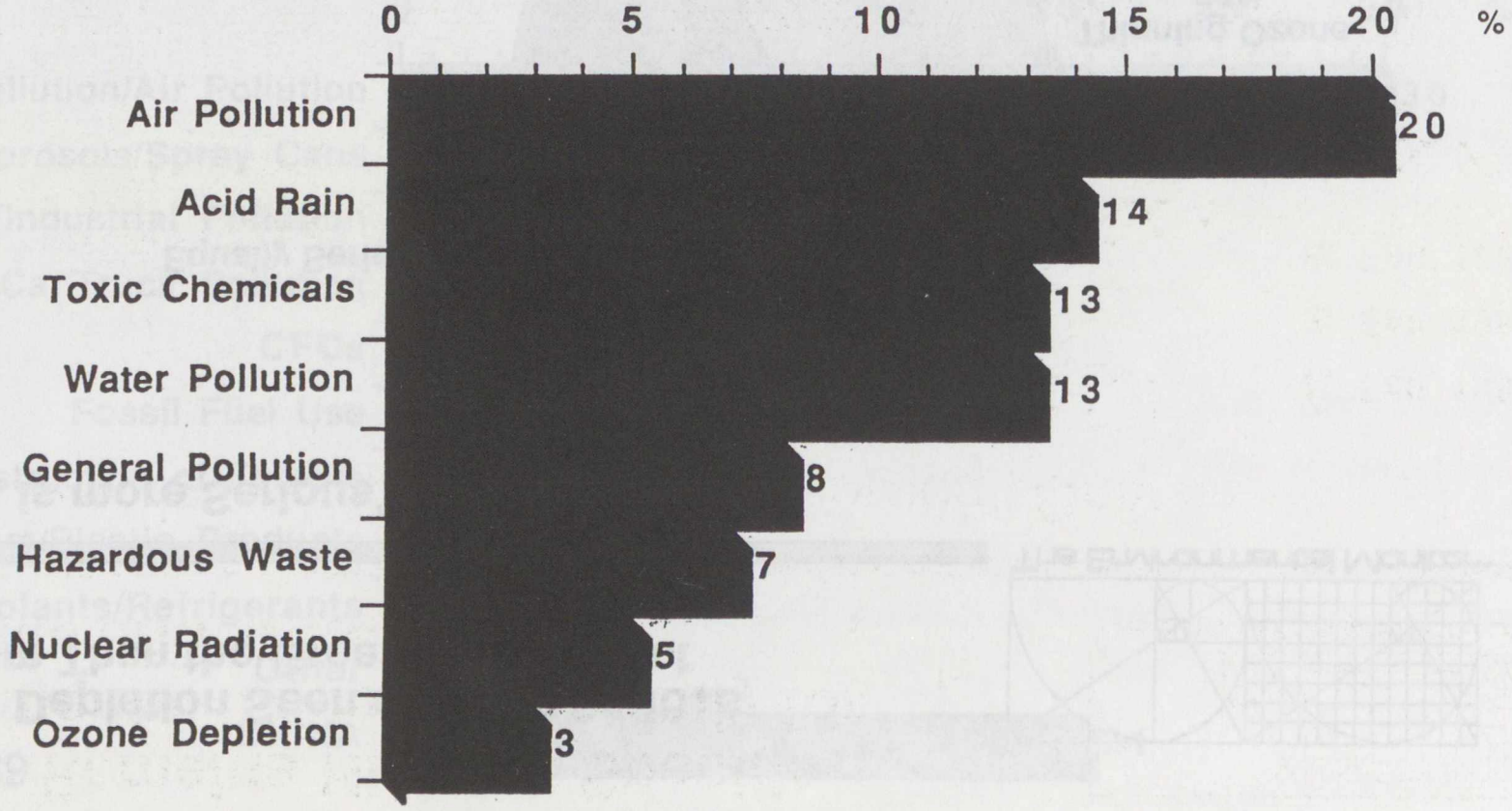
Concern Levels "Very Concerned" Only



Air Pollution is Seen as the Greatest Threat to Health

The Environmental Monitor™

Greatest Threat to Health (Open-Ended Responses)

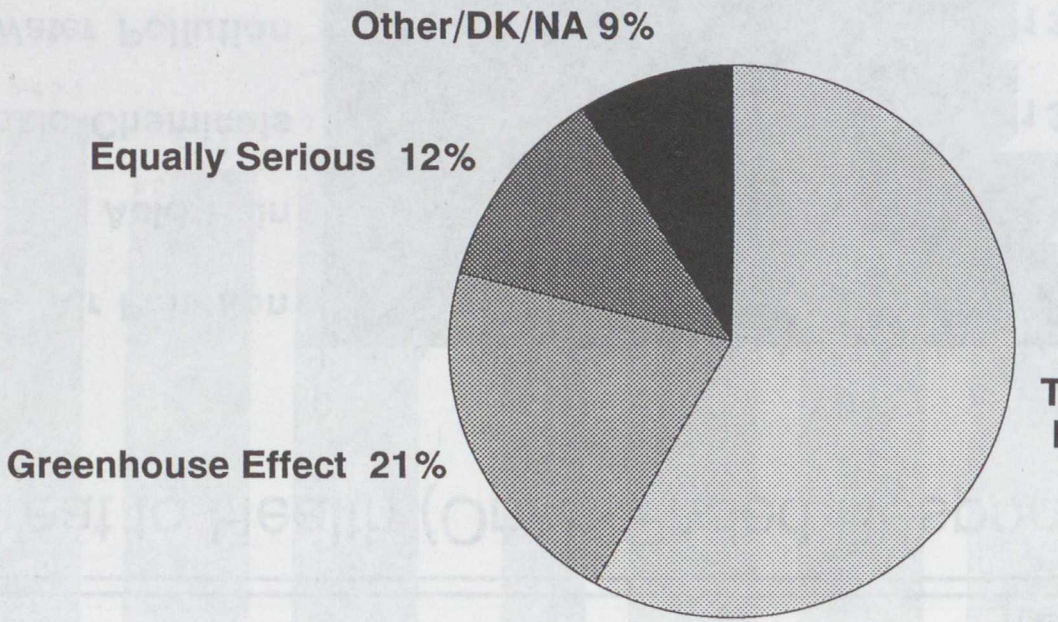


Fall 1988

Ozone Depletion Seen as More Serious Problem Than the Greenhouse Effect

The Environmental Monitor™

Which is more Serious?

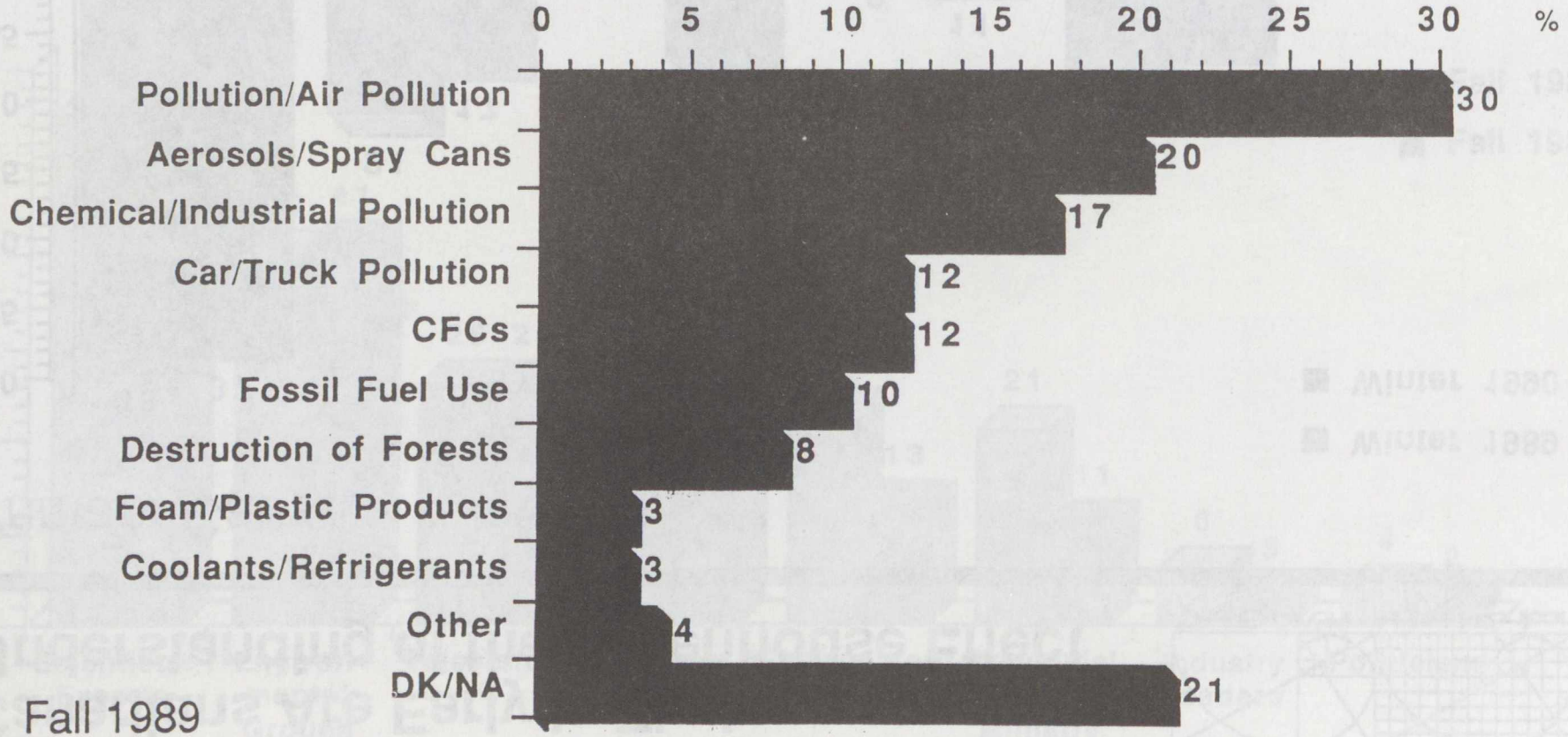


Fall 1989

Only One-in-Three Can Correctly Identify Causes of Ozone Depletion

The Environmental Monitor™

Primary Cause (Open-Ended Responses)

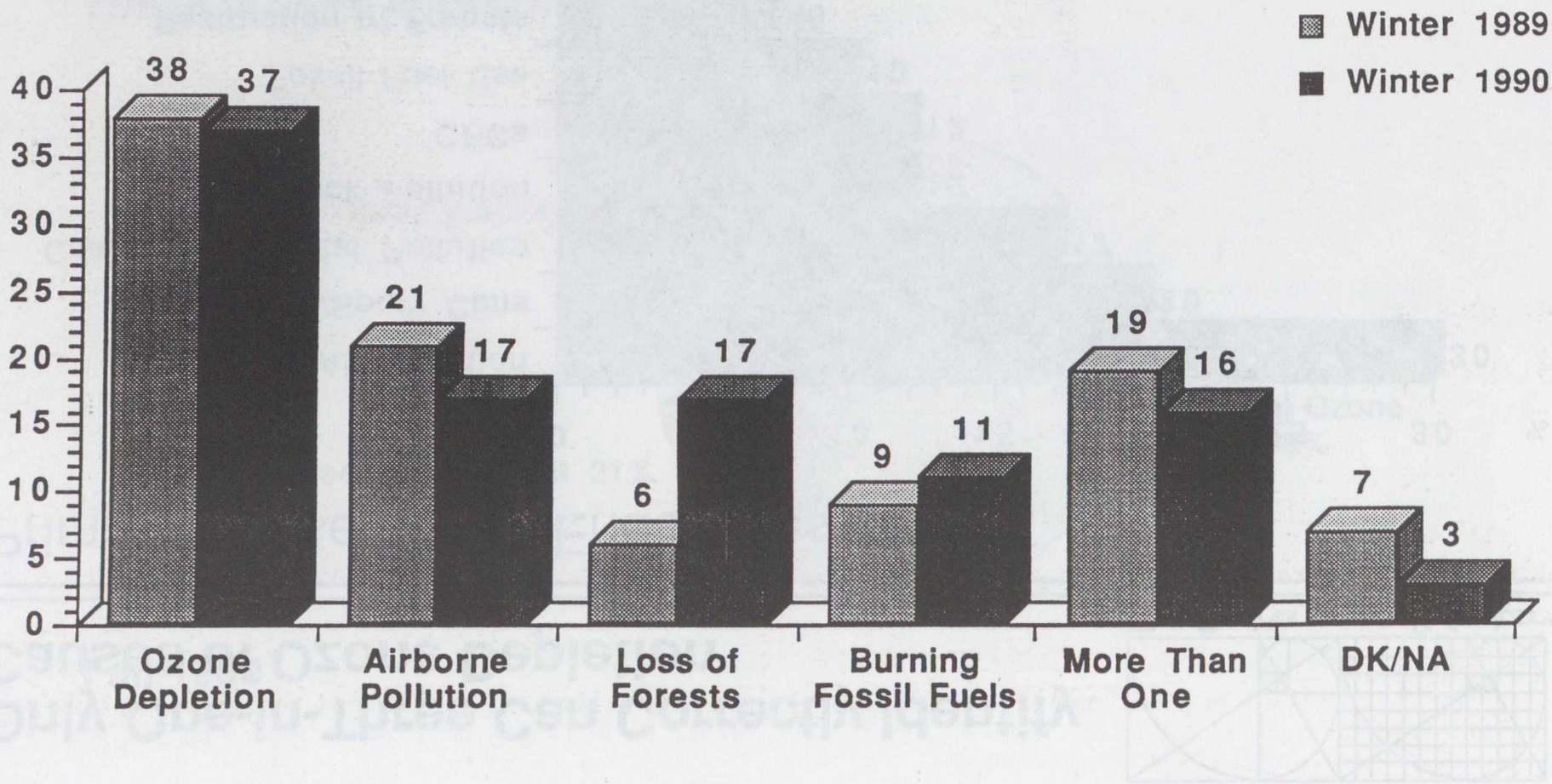


Fall 1989

Canadians Are Early in Their Understanding of the Greenhouse Effect

The Environmental Monitor™

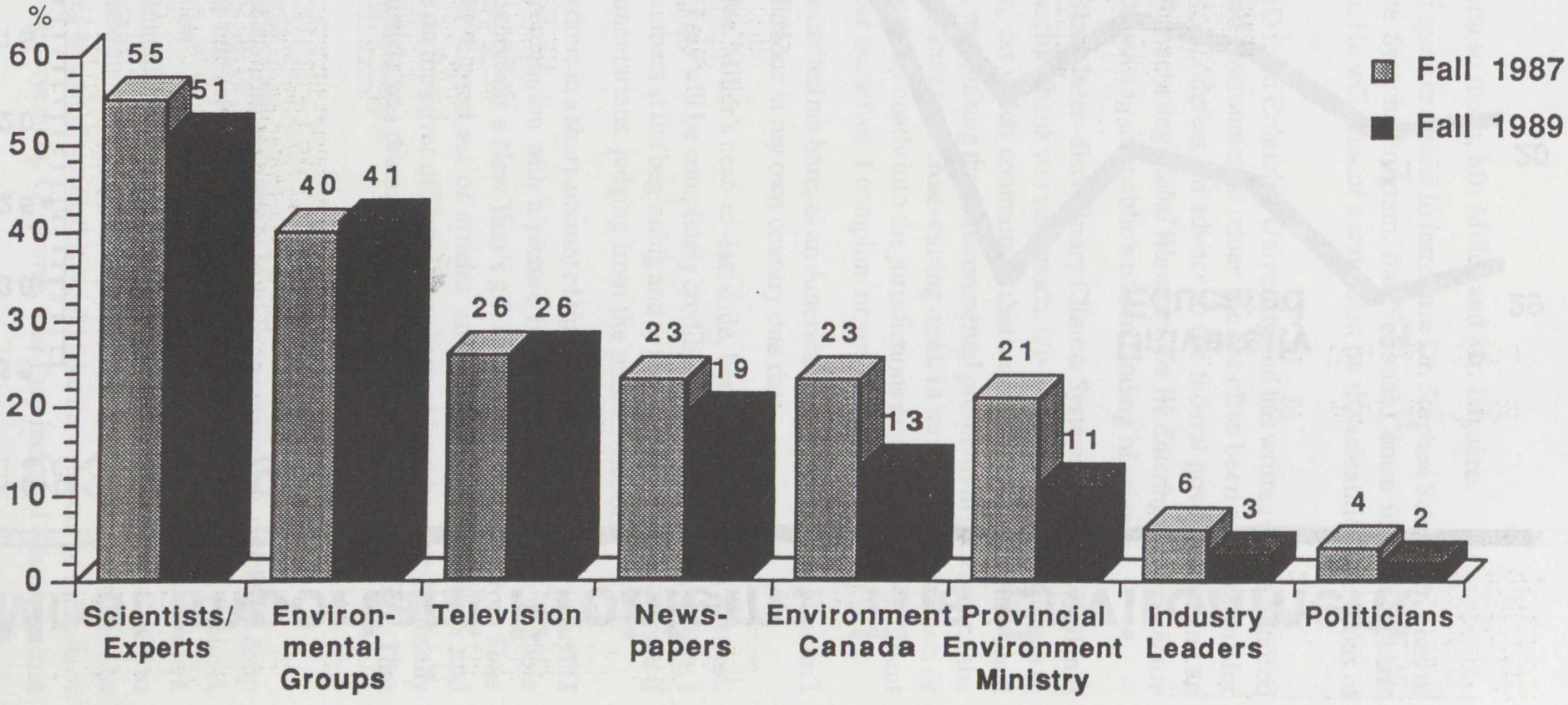
Primary Cause



Scientists and Environmental Groups Are the Most Trusted Sources of Information

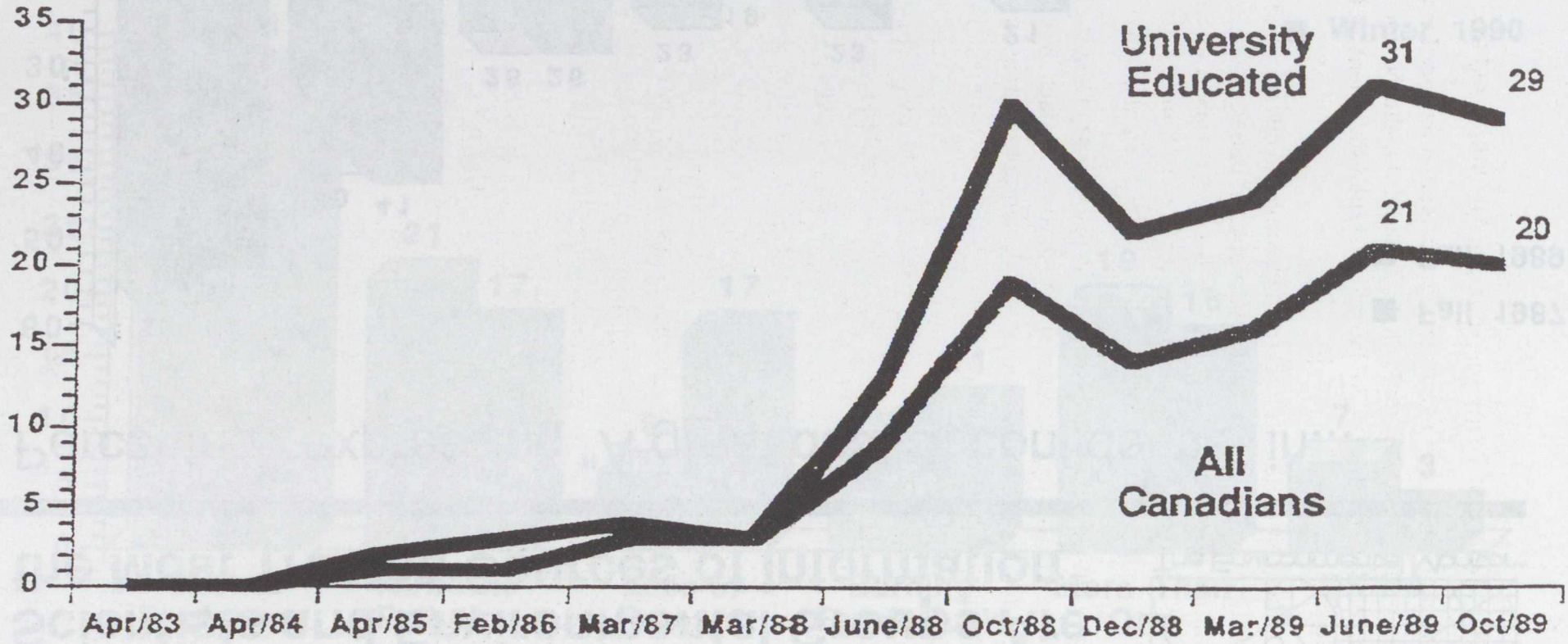
The Environmental Monitor™

Percentage expressing "A great deal of confidence" in...



Most Important Problem: The Environment

1983 - 1989



The Chairman: Thank you so much, Mr. Miller and Mr. Giguère.

We move now to the next speaker. I want to introduce Dr. Stephen Schneider, head of the Inter-disciplinary Climate Systems Program, the National Centre for Atmospheric Research, Boulder, Colorado. He will present a statement on the scientific dimensions of climate change.

Dr. Schneider holds a PhD from Columbia University and has written over a hundred scientific papers on climate and environmental issues. He has often been a spokesman for climatology as a witness before Congress, an adviser to the federal government, and an author of several popular books, including *Global Warming: Are We Entering the Greenhouse Century?* He is interested in advancing the public's understanding of science.

Dr. Stephen Schneider (Head, Inter-disciplinary Climate Systems Program, National Centre for Atmospheric Research): Thank you very much. It is an honour and a privilege to address this historic occasion, on which committees that normally deal with individual subjects have joined together, recognizing that environmental problems in general and the global warming problem in particular are cross-cutting ones. In terms of their impacts or solutions, these problems do not fall neatly into the jurisdictions most of us in government or in academics have set up for ourselves. I compliment you for that.

I appreciate that you have invited me here, as an American, which is a double honour. I hope I might have the same honour in my own country one day.

I am also pleased to see Mr. Miller's next-to-last slide, because since I am a scientist, you will know that everything I say will be completely credible. As you showed that slide, I was wondering whether the numbers at the beginning and at the end would have reversed if you had polled various parliamentarians, judging from the public reaction.

There is a great deal to be done in a short amount of time, so let me proceed. I thought I would begin this technical presentation with a picture from one of the highly credible scientific sources. This cover story was a New Year's gift to the world in 1989 from *Time* magazine and included rather a good set of articles on environmental problems and reminded us that when we are on the cover of *Time* issues have at least become politically and publicly important. The article was dramatic, and indeed some of it was scary. That tends to lead to reactions.

.1130

So in the same year we got a Christmas present from *Forbes* magazine, which in a coup of journalistic balance had the title on the front cover of "The Global Warming Panic: A Classical Case of Over-Reaction". The inside story, which is unusual in journalism, had a scientific picture—this is the annual average temperature fluctuating from around 1900 to about 1988 in the lower 48 united states. And the article went on to say that since there was essentially no trend in the lower 48 united states, this would take the wind out of the sails of the over-hyped global warming movement. Of course, had they included Alaska in that

picture it would have had three-tenths of a degree Celsius warming, and had they averaged it over the whole world they would have found that about half a degree Celsius warming had taken place. But it was much more convenient to show what fits the preconception you have.

In any case, if you read the media—which is the reason I showed these pictures—you will generally find, certainly in the United States... [*Technical Difficulty—Editor*]...that there are two sets of technical experts. One suggests that global warming is imminent and certain and will be a total disaster. The other one says it is totally uncertain, that we do not know much about it, that if it happens at all it will probably be good for us, and in any case it would bankrupt us to do anything about it.

So the impression one gets, certainly in my country, in the vast bulk of the media stories, and certainly the vast bulk of the opinion pieces in newspapers and on television, is that it is an implacably divided and disagreeing scientific community.

I will argue in the next 20 minutes and try to convince you that the caricature of the debate really is the two least likely cases; that almost anything in between the end of the world and nothing at all is much more likely, and that the bulk of the scientific debate is over details and not over the basic nature of the problem; and that while legitimate uncertainty remains, and will continue to remain for decades over precisely where and when changes will occur, the vast bulk of responsible experts believe that we have a substantial chance of unprecedented change.

Now that I have said that, let me try to prove that. Well, there is lots that we know. On Loa Mountain in Hawaii, which is about 10,000 feet high, somewhere around 3,000 metres, is the Mauna Loa Observatory, which sits on this volcanic mountain. The white stuff is what happens when you go to 3,000 metres elevation. In January you can find snow in Hawaii. And up above my head there is an air intake, and this was set up in Hawaii 30 years ago because of the relatively clean nature of the air. We were trying to sample air that was essentially undisturbed. It turns out it is not undisturbed; it is disturbed. But if you measure it when the winds are blowing from the ocean you can get.... This air intake over here feeds into this bank of instruments. This one in particular measures outside air for 10 minutes and then a known sample, and then back and forth. So it is constantly recalibrated.

It was very exciting to me to stand next to this instrument, which literally may change the course of industrial civilization. The reason for that is it has produced a very well-known record, which is the carbon dioxide content of the atmosphere at Mauna Loa Observatory. Now, this is not a record unique only to Hawaii, but time does not permit us to show that the same basic trend occurs at the South Pole, the North Pole, in Australia, and so forth.

But the basic thing you see here is the amount of carbon dioxide, measured along this axis, and time, from 1958 through to 1989, along here. And you can see there is a cycle. If one looked in detail you would see that this is an annual cycle, the peaks of which occur in the spring; and then over the next six months, when the sun is high and the grass is green and

the leaves come out, photosynthesis works—that is, the carbon dioxide is removed from the air by nature, by the biosphere, and incorporated into what we call the seasonal biosphere—and the carbon dioxide drops. Then in the fall, when it gets colder and respiration and decay proceed faster than photosynthesis, it builds back up.

This literal breathing of the planet that we see every year is a natural cycle. We alter it by changing the amount of biomass that humans involve themselves in, through deforestation, agriculture, or changes in habitat.

But primarily the main thing to see here is a 10% increase in the total amount of carbon dioxide. Now, there is no dispute about this; this is not under argument. There is also no dispute that the cause of this is human activities. There is a dispute over the relative amounts that are from fossil fuels, deforestation, and so forth. I will talk briefly about that. But the facts are that we have increased it by this much.

.1135

Another fact is that if we look at the polar ice-caps, where of course snow falls continuously, and as far as we know has over the past several millions of years, the air bubbles that get trapped in the snow as it gets compressed into ice give us literally a library, a history of the concentration of gases in the atmosphere over hundreds of thousands of years. What those bubbles tell us is that during the past 10,000 years, the so-called warm or interglacial period in which civilization grew, the concentration of carbon dioxide was always below about 300 parts per million and bounced around between about 270 and 290 parts per million. This increase we have seen is only a modern phenomenon, only post-Industrial Revolution. And once again there is essentially no doubt we are responsible for that.

In any case, the carbon dioxide I am telling you about...we know it is a global change, but does it matter? To do that, of course, we have to talk about the greenhouse effect, since it is a principal so-called greenhouse gas. Let me try to explain that.

The next slide shows how the greenhouse effect works. I will try to convey to you that the public is right in giving us in science some credibility, because the fact that we have numbers on the chart tells us we have measurements.

The greenhouse effect as a scientific proposition, despite what you may hear or read, is not at all controversial. No scientists I know of, knowledgeable in the atmospheric sciences, deny that water vapour, carbon dioxide, methane, chloroflorocarbons, in clouds, for example, trap heat near the earth's surface. The way it works simply is if you take the sunlight and break it down into 100 percentage units—really it is 340 watts over every square metre of earth—then about 25% is absorbed in the atmosphere, about 25% immediately reflected.

Notice in this cartoon I drew it being reflected from clouds. Well, you can look right up there on the wall and you can see a picture of the planet Earth from space. Those viewing at

home who have seen such satellites will know the main thing you see is the swirling white masses of clouds and the white polar caps. The white means it is bright and the sunlight that was coming to the earth is not available to heat the planet but is rejected and reflected away by those clouds. In a sense they are like the venetian blinds in your house. They control the amount of sunlight that comes in. They are critical to the overall warmth of the planet.

About half the sunlight, 45%, gets to the earth's surface, where it warms the surface. The surface would continue to heat up if something did not take the same amount of heat away as it comes in, and there are two somethings. The first we are calling "atmospheric processes", about 29%. Those are mostly the evaporation of water, which is a very strong cooling process for the surface, and a bit of thermal contact, where you can see the heat rising from dry surfaces.

Then there is another term over here. Lots of energy leaves in the form of so-called "long-wave" or infra-red radiation. Every object with a temperature gives off energy. The amount of energy the earth gives off is much less than the sun does, of course, but the amount it gives off is in a longer wavelength. It is equal to the amount of sunlight absorbed in the earth, but not at the surface. A large amount leaves the surface: 104 units. The reason the earth's surface is not cold is that the atmosphere—the gases, the water vapour, the carbon dioxide, the clouds—traps most of the outgoing heat and re-radiates it back to space and down to the surface. It is this re-radiation to the surface that makes the greenhouse effect work.

Again, this is not speculative. It has been measured millions of times in the atmosphere by balloons and aircraft. It has been measured literally trillions of times from earth satellites. It is not debated. The precise numbers are.

We also know for sure the amount of carbon dioxide, methane, and chlorofluorocarbons we have added in the last century has put over every square metre of earth about two watts of extra energy in the form of infra-red heat being trapped. That is like a little Christmas tree bulb in a wavelength you cannot see over every square metre of the earth. That again is not debated.

So what is debated? What is debated is how to translate the two watts of extra heating that has happened so far into x degrees of temperature change. That is tough. In order to do that you have to know how much of that energy is distributed in evaporation, how much in infra-red, how much in pure temperature rise. You need to make assumptions about how clouds change, how ice masses change, and these changes—what we call feedback mechanisms—can either amplify our answer, making it worse than we think or damp it, making it less. When you hear debates in the newspapers reflecting the legitimate arguments of scientists, it is over whether we are more or less likely to have nature amplify or reduce the calculations we otherwise make.

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I wish—and I will give you my bottom line in advance—I could tell you we knew the answer. What we do know is roughly the magnitude and rates at which we are heating the planet and a fairly decent sense of how much rise that should be relative to natural changes. Most scientists are quite concerned about those magnitudes and rates, but nobody I know of, who is a responsible scientist, would claim that we understand the details, nor would any responsible scientist claim that they are extremely likely to be a non–issue.

Let us proceed then and talk about what we must do in the future. We must make a projection, first of all, not simply of how the climate will change, not how the clouds will change—what that might mean for agriculture, water supplies, human health, forest fires, sea level, all the litany of potential problems. At the outset it is not biology and not physics that are the most uncertain, but human behaviour. What people will do will, in my view, is at least as uncertain in terms of forecasting the future as what nature will do.

This chart shows the projected concentration of carbon dioxide from 1980 forward to 2220, a very long projection. Obviously nobody who wants to maintain even an ounce of credibility is going to pick a single curve and tell you that is going to happen. What we have to do is project "what ifs", and the "what ifs" have policy relevance because what they tell you is what might happen if we allow energy to grow at 4% per year or 2% or 1%, or if we hold emissions constant, or if we take Amory Lovins's advice and we cut emissions by 2% per year over the next several years.

So these show what the build–up of carbon dioxide in the atmosphere might be in the future, depending upon what we do about energy strategy. And if we allow fossil fuels to grow at 2% per year it suggests a doubling of the carbon dioxide some time in the middle of the next century. If we hold emissions constant, it stretches that out 100 years and so forth.

Now, at the top I have sketched in a rather classical equation from Horlick and John Holdren called "the population multiplier". It tells us two things: bad news, good news. The bad news is it is going to be very difficult to project accurately. The good news is there is a lot we can do about it. Let me explain.

The first term that we want to look at in this equation is the carbon dioxide per technology. What we are trying to see here is the total carbon dioxide emission from the planet. That is equal to a product of three terms, the first one being engineeering. If you are using a solar machine or a nuclear machine, then that puts out no carbon dioxide per unit energy, except what it takes to build that machine and decommission it, which may not be zero. We have to do whole system accounting. I am not suggesting that carbon dioxide is the only reason for making an energy decision, but it is certainly something that we need to consider. In the past it has not been directly considered, certainly not by any legislative action.

The second term is technology per capita. Now, that is a fancy sounding way of saying something that is extremely volatile politically. Technology per capita is another statement

of standard of living. And it is even more politically volatile when that discussions takes place, as we will hear later from Jim MacNeill, in developed and developing country context.

The third term is population size. I have shown this equation in a number of places, including in the United States. I once was accused of ideology because I showed an equation with population in it. Now, it is hardly ideology to make a statement of the conservation of mass. It is quite simply the total emissions of anything per technology, the amount of technology per person, the total size.

Now for the good news. As complicated as it is to forecast any of these terms, you can choose if you wish. If you want to avert one of these outcomes or the others, what you could do as a nation might be to work on this term if you are so inclined. If you are in a high population country you might work on this term. If you already have a high standard of living you might hold this one back. With a low standard of living you would work on this. Jim will talk about that, but the point is we have many options in this kind of control.

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Fossil fuels are not the only cause of carbon dioxide build-up. Deforestation, in this case clearing land for rubber plantations in Malaysia, also causes build-up. A tree is perhaps a tonne of carbon. It takes 30 years to grow. It takes that carbon from the air, and then in 30 minutes you get it back when the land is cleared. So perhaps 20% of the total build-up of carbon dioxide in the past decade is due to deforestation, and that number has presumably been accelerating in the past decade. That is controversial. The number ranges from about 10% to 30%, but, again, we know the magnitude quite well.

Carbon dioxide is not the only greenhouse gas. Chlorofluorocarbons are an important one, maybe 20% of the story. Another gas which has doubled since the industrial revolution is methane. It is produced in agriculture through flooding of fields, because methane is produced in soils when the soils have no oxygen in them. Lots of it is stored under the tundra. If there is substantial warming of the earth, there may be a lot of fossil methanes stored in the tundra in Canada and offshore that would come out into the air. Methane is actually 30 times more effective in trapping heat than carbon dioxide. The reason carbon dioxide is still the dominant gas is that there is so much more carbon dioxide, but as methane increases from landfills, rice paddies, animals and so forth, it too contributes to global warming.

Here is a mature rice field putting lots of methane up there, and we are certainly not going to ask people to stop growing rice. This again shows the point about the connection between population and the technology you use.

If we make scenarios of the future, we then ask what if and we use theories to do this. People will ask how you know how much a certain amount of increase in carbon dioxide and methane is going to change the climate. The first thing we do is go backwards and ask what happened when we doubled carbon dioxide before. Unfortunately, that appears to be an

unprecedented experiment. While millions of years ago it is possible that carbon dioxide was twice as much as it is now, no one was measuring it; no one was measuring the climate, and therefore we have nothing but sketchy evidence. In fact, during those periods, such as the eras of the dinosaur, we know the world was substantially warmer.

At best, it is circumstantial evidence. You cannot use it for any quantitative determination. We know that the last ice age, which ended about 10,000 years ago, had about 25% less carbon dioxide at its peak than during the present interglacial. So carbon dioxide went up by nature from about 15,000 years ago to about 5,000 years ago. It took nature about 10,000 years to do that. It also took nature 10,000 years for the ice age to disappear, and an ice age is only about five degrees celsius colder than an interglacial. So we are talking about natural rates of change of about five degrees or so in 5,000 to 10,000 years. That is one degree Celsius per 1,000 years of typical natural rates.

What was the global response to that? Sea levels rose 100 metres. Habitats were radically altered. Forests shifted thousands of kilometres. The present boreal forests of Canada were in the hardwood forest zones, mostly in the corn belt in the U.S. now, and the rate at which those forests adapted was sufficient that they could move to keep up with one degree per millennium. What we are talking about here is a projection made by an international group several years ago suggesting change anywhere from as little as one-half degree additional warming to as much as 5 to 10 degrees warming. Remember, we are talking about rates of one half degree per century. The small number is five times faster than natural average global rates of change. The large number is 100 times faster.

It would be arrogant nonsense for me to get up and tell you that we in the scientific community can predict precisely the ecological and other consequences of rates of change 10 to 100 times faster than natural rates when we are struggling to explain what happened to the natural rates. Our skill is in suggesting something about the rates and magnitudes. Our skill starts to disappear when predicting precise consequences, which is why you will hear scientific assessment bodies again and again saying things such as unprecedented climate change in the era of human civilization, major changes in the patterns of forests and water supplies. But as soon as somebody who happens to run a water supply district in Manitoba asks you what is going to happen exactly there, we begin to wave our hands around and say we do not know. It is simply because the forecast of that requires coupling of certain computer models that is beyond the state-of-the-art skills in detail.

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This is typical, by the way, of what the state of the art produces. I said it was beyond the state-of-the-art skill. Actually, what I meant was that reliable forecasting was beyond the skill. Anybody can make a forecast. The question is, is it any good? This is typical of the forecasts that we make. I give this a better than even chance of being right, but not much better.

What it suggests is whether the soils would get dryer or wetter in the summer months in the northern hemisphere if carbon dioxide were doubled. It is from the geophysical fluid dynamics laboratory, a U.S. government lab. Dr. George Borg, here in Canada, also has models that produce results comparable to these. These are typical of what you would see around the world.

I heard from the opinion polls that some people think that agriculture might improve if the earth warmed. In the sense that growing seasons would lengthen, that is possibly true. In the sense that more carbon dioxide in the air would fertilize plants and make them grow faster, that is also possibly true. But if soil moisture is decreased 30% to 60% across most of North America and central Asia, I wonder how many of you would think this would improve crop yields. The point is that many things change, and we do not yet have the skills to say precisely which one is likely to happen where and when. What we are looking at is a gamble with these of kinds of changes being plausible.

Getting 20% to 100% wetter in the Indian subcontinent is a typical forecast. Reliable monsoon rainfall could be very nice in India, provided that somebody spent the trillion dollars developing the flood control and irrigation infrastructure. If not, then the flooding would probably be worse as a detriment than the rainfall would be as a boon. So whether it is good or bad depends on many factors including financial resilience, adaptation time, and forecast capability.

I am trying to get you to take possibilities such as this seriously, but not literally. We cannot claim accuracy, but the large changes in soil moisture are true from one model to the next and will probably prove true over time.

What kinds of things could we get? I have tried to argue that, when we insult the environment much faster than nature has changed it, surprises are inevitable. Opinion pollsters tell us that health is on the mind of the public, though the public has not yet made a connection between climate change and health.

A study done by the U.S. Environmental Protection Agency simulated tick densities from selected cities under various scenarios of climate change. Ticks carry diseases: Lyme disease, Rocky Mountain spotted fever, and so forth. Where these ticks live is determined to a large extent by climate. In Richmond, Virginia, there are many ticks and tick diseases; Columbus, Ohio, the same; Halifax, Nova Scotia, very few; Montana, none, because it is too cold and dry.

Now, what happens if we take the scenario of GFDL, the computer model I showed you earlier? If we look at Richmond, Virginia, we see an improvement. They have decreased the number of ticks. Columbus, Ohio, has improved. But Halifax, Nova Scotia, becomes the tick capital of North America. That is a distinction it probably would rather not have in the chamber of commerce ads.

The point is that there are many changes that will take place in environmental variables. These will affect health and well-being. They are not part of the price of doing

business, and are not charged the cost of the energy systems we use. There is a certain gamble we take if we commit the earth to performing experiments with magnitudes 10 to 100 times greater than the natural rate. That is the area where I think most scientists are in agreement. It is not the details that they agree about.

In my country, in the State of Missouri, the licence plates bear the famous Harry Truman philosophy, "Show me". Why should somebody believe a computer model can project the future? I told you earlier that we cannot look backwards in order to project, because what we are doing is unprecedented. We have no laboratory experiment that is remotely as complex as reality, so we are forced to build an experiment and we run it inside the microchips of computers. We run a model that predicts the present climate. We predict clouds, we predict oceans. Sea ice is a very complicated business.

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Since I have already told you we cannot predict all those elements precisely, how do we have any confidence in these models at all? How do you validate them? How do you show someone from Missouri? Well, the single best way to validate the model is to ask how well it does in reproducing the very largest change in climate whose we cause we are familiar with. That, of course, is winter and summer. We know why the winter is cold and why the summer is warm. There are 100 watts over every square metre of earth, different solar heating from winter to summer. It causes temperature changes in the order of 30 degrees Celsius from winter to summer.

The upper chart shows those changes. Here is the 20-degree/30-degree line, 40-degree/50-degree here in northern Canada and in Siberia, about 10 degrees difference in Australia. The upper one is observed data; the lower chart, the lower map, shows how well computer models do in reproducing these very large changes. What you see is typical. The regional patterns are not precisely correct—see the closed circles here, it is open circles here—but the overall continental to hemisphere scale numbers are pretty good. If we were making a factor-of-10 mistake in trying to estimate what the future would be, it would not be possible to reproduce this observed record this well.

What this tells us is that the statement that you see again and again from U.S. National Academy of Science's studies, from the International Council of Scientific Unions, and now the Intergovernmental Panel on Climate Change Report, which I have seen in draft form—they have said the same thing for 15 years, and none of the debate that we have been reading about now has fundamentally changed that conclusion—that the next century, the middle of the next century, to the end, is likely to see 1.5 to 4.5 degrees Celsius increase. Now it does not mean less can be ruled out; it does not mean more can be ruled out. But it is on this kind of circumstantial evidence that we base that.

I remember showing such a picture back first time I ever talked to the U.S. Congress—a single committee, not a joint one. That was in 1976. One of the congressmen, a senior and battle-worn political veteran, said to me: Son—which I guess fitted me at that

time—you mean to tell me you guys have spent $1 billion of our money telling us that the winter is cold and the summer is warm? I remember I said: Yes, sir, we are very proud of it. I should have said: Read my lips, we are very proud of it. But what I said that for, and I say again, is that if our models could not independently reproduce the 15-degree-Celsius difference between winter and summer in the northern hemisphere, the 5-degree-Celsius difference between winter and summer in the more oceanic southern hemisphere, then what good would it be in trying to predict 2 or 3 or 4 degrees Celsius warming into the next century?

This is strong circumstantial evidence. It is not direct evidence, but it is circumstantial, and of a strong nature. There is direct evidence, such as the ice age interglacial cycles having the temperature and the carbon dioxide follow each other.

But what of the last century, which is a very debated point, and I will close with this? This record shows the temperature fluctuating from 1860 through about 1988. Here are 1988 and 1987, the two warmest years in the record; 1989 was down about there but it was still one of the six warmest. The decade of the 1980s was the warmest decade over the instrumental record. Here is the increase in carbon dioxide, methane and so forth. If you look at it there is a superficial resemblance. That is direct evidence. But we have a problem. It is like any detective story. We have a crime, which is this warming trend of 0.5 degree Celsius. We have our leading suspect, but we have problems. Here it warmed up rapidly, there it is sort of cooled down, then it rewarmed. That is not an exact replication of this trend. Is that because our models are wrong, or is that because other things are going on? Almost certainly other things are going on.

The problem is the last hundred years, the noise, the bouncing around of the climate due to natural processees, is so large that we are just now at the threshold of seeing what we call the signal emerging from that background noise. It will take us 10 to 20 more years to achieve the 99% certainty that scientists love. The problem in achieving that certainty is that it is not an academic exercise because we are performing this experiment in our laboratory, earth, of course, and we and every other living thing are along for the ride. That is a value trade-off as to whether or not we do something about it, and not a scientific question. Scientists will not be able, in my opinion, to resolve that issue definitively in the timeframe of 10, maybe even 20 years. Therefore, the question is whether we can find ways to slow it down that also make good economic and political sense.

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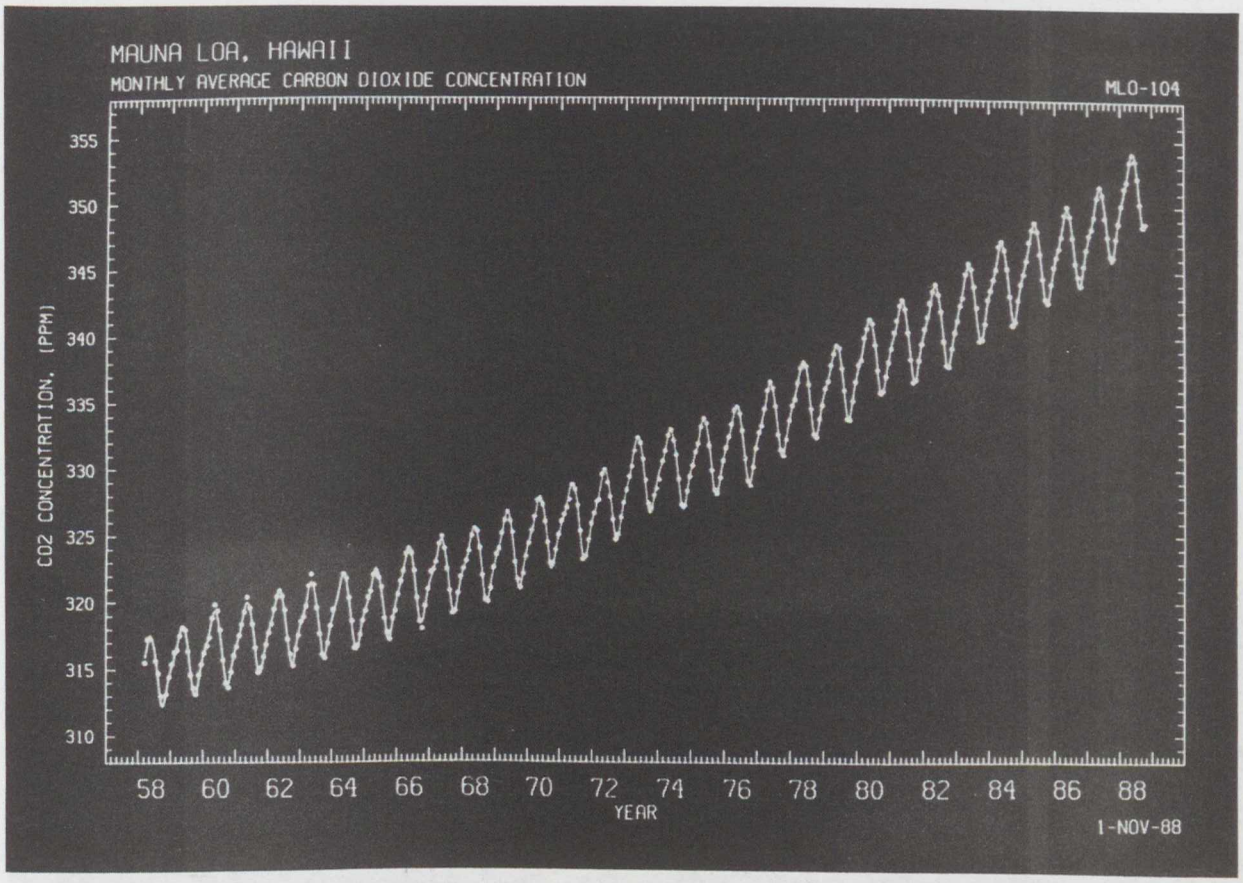
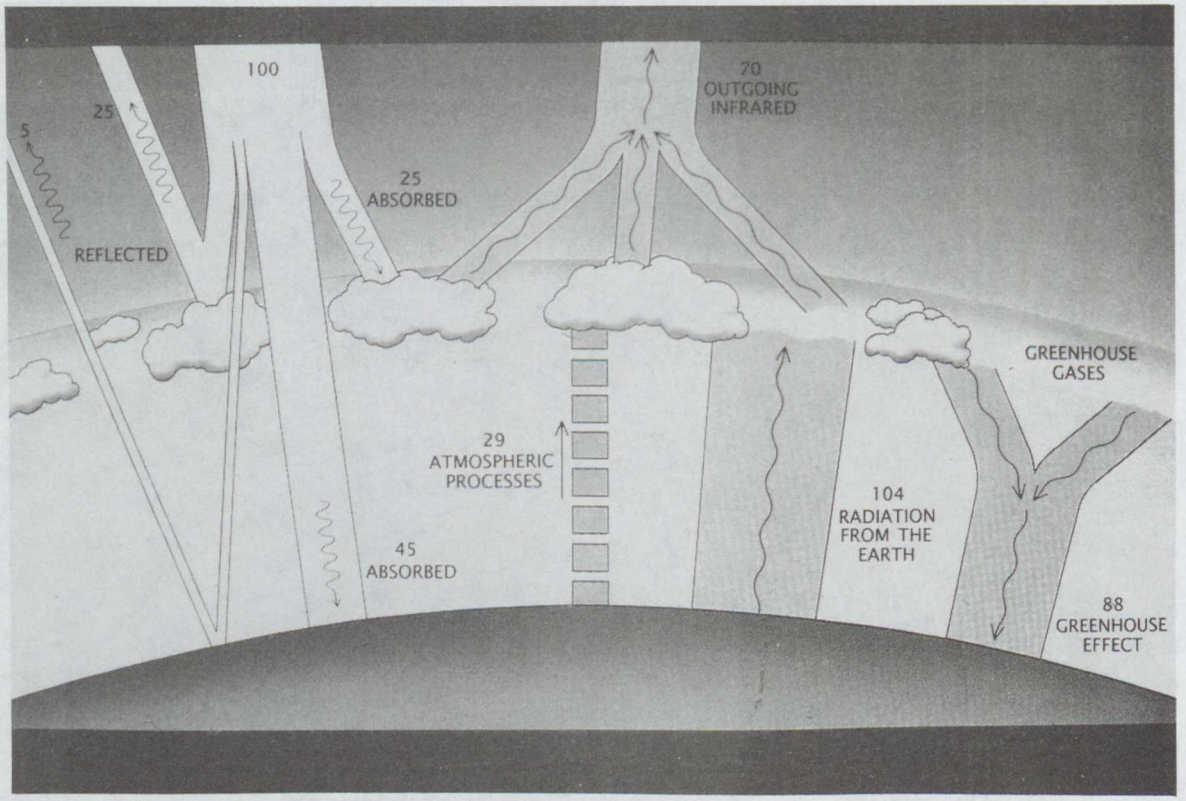
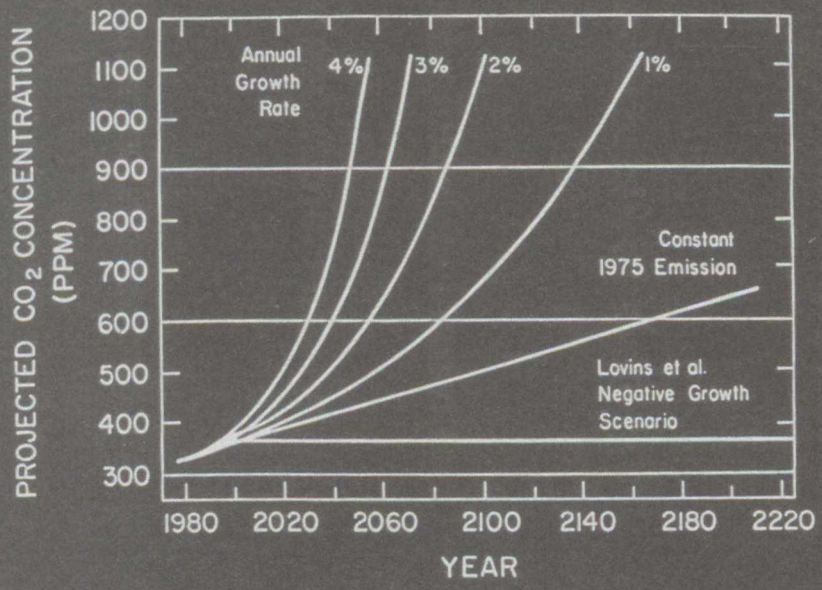

MAUNA LOA, HAWAII
MONTHLY AVERAGE CARBON DIOXIDE CONCENTRATION
MLO-104
CO2 CONCENTRATION, (PPM)
355
350
345
340
335
330
325
320
315
310
58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88
YEAR
1-NOV-88

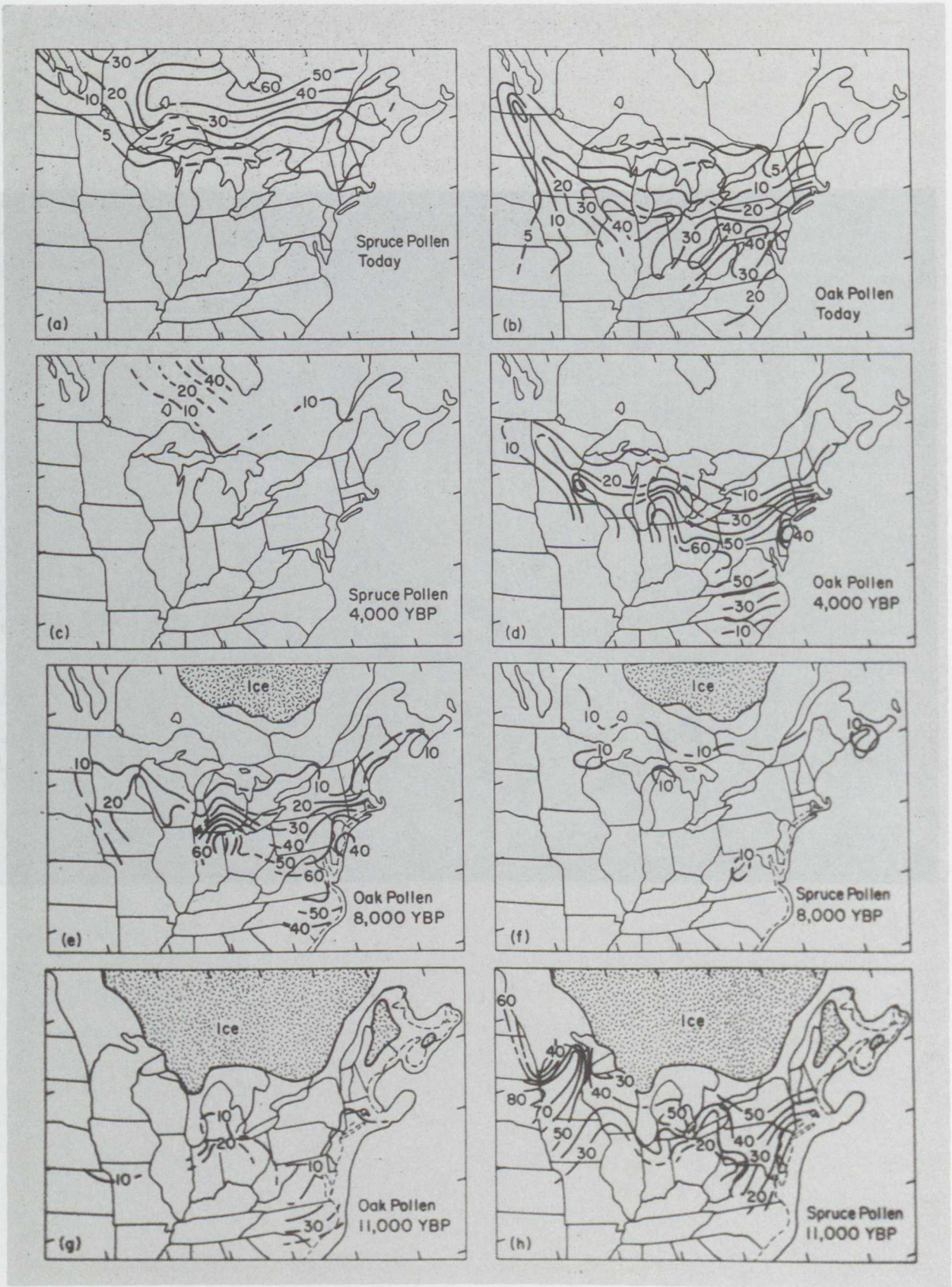

100
25
5
REFLECTED
25
ABSORBED
70
OUTGOING
INFRARED
GREENHOUSE
GASES
29
ATMOSPHERIC
PROCESSES
104
RADIATION
FROM THE
EARTH
45
ABSORBED
88
GREENHOUSE
EFFECT

Ehrlich/Holdren "population multiplier"

$$\text{Total } CO_2 \text{ EMISSION} = \frac{CO_2}{\text{Technology}} \times \frac{\text{technology}}{\text{capita}} \times \text{Population Size}$$



Various CO_2 scenarios based on specified sets of energy growth assumptions (Lovins et al., Least-Cost Energy: Solving the CO_2 Problem, Brick House, Andover, 1981.)


Spruce Pollen
Today
(a)
Oak Pollen
Today
(b)
Spruce Pollen
4,000 YBP
(c)
Oak Pollen
4,000 YBP
(d)
Ice
Oak Pollen
8,000 YBP
(e)
Ice
Spruce Pollen
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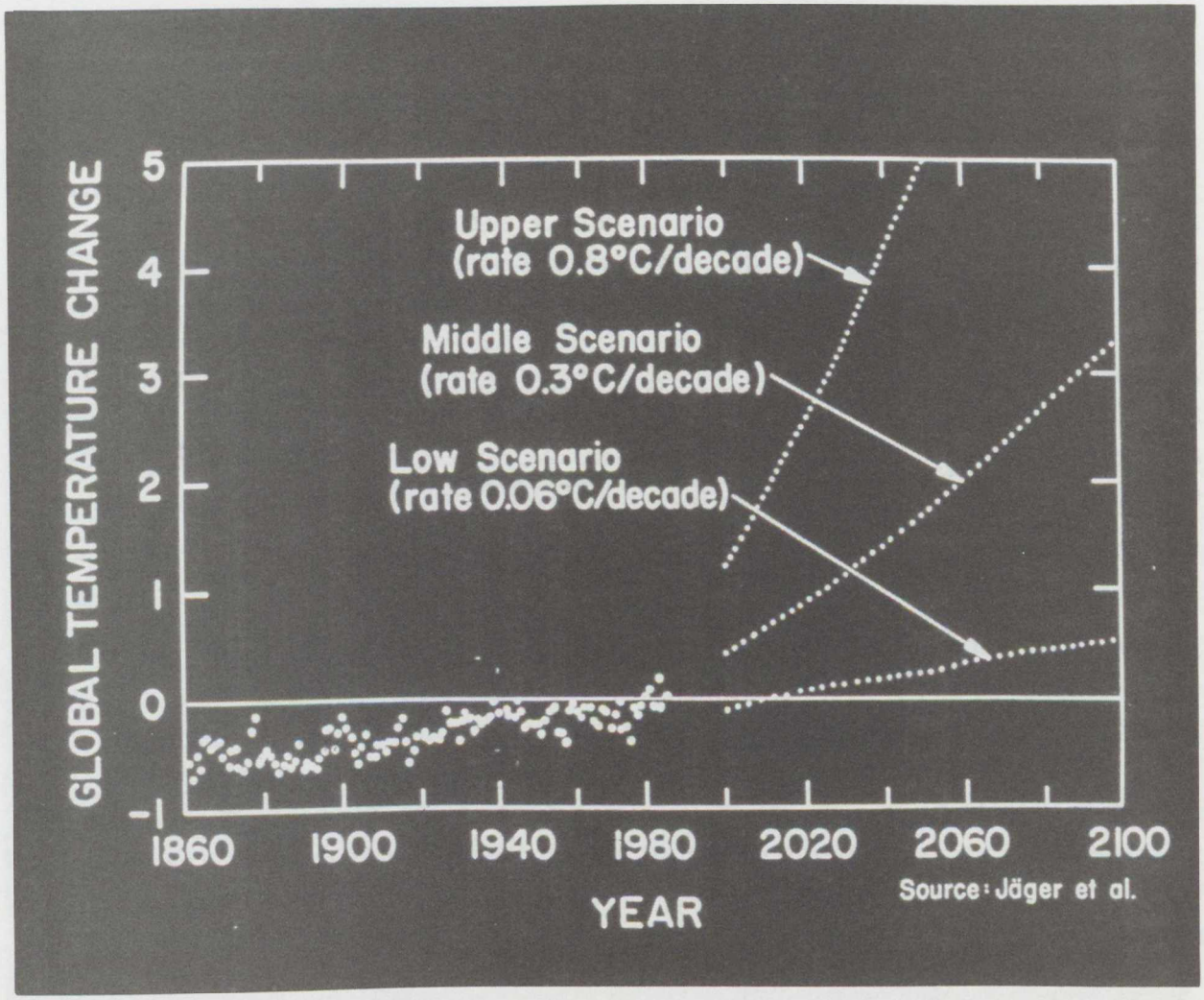
Oak Pollen
11,000 YBP
(g)
Ice
Spruce Pollen
11,000 YBP
(h)


GLOBAL TEMPERATURE CHANGE
5
4
3
2
1
0
-1
Upper Scenario
(rate 0.8°C/decade)
Middle Scenario
(rate 0.3°C/decade)
Low Scenario
(rate 0.06°C/decade)
1860
1900
1940
1980
2020
2060
2100
YEAR
Source: Jäger et al.

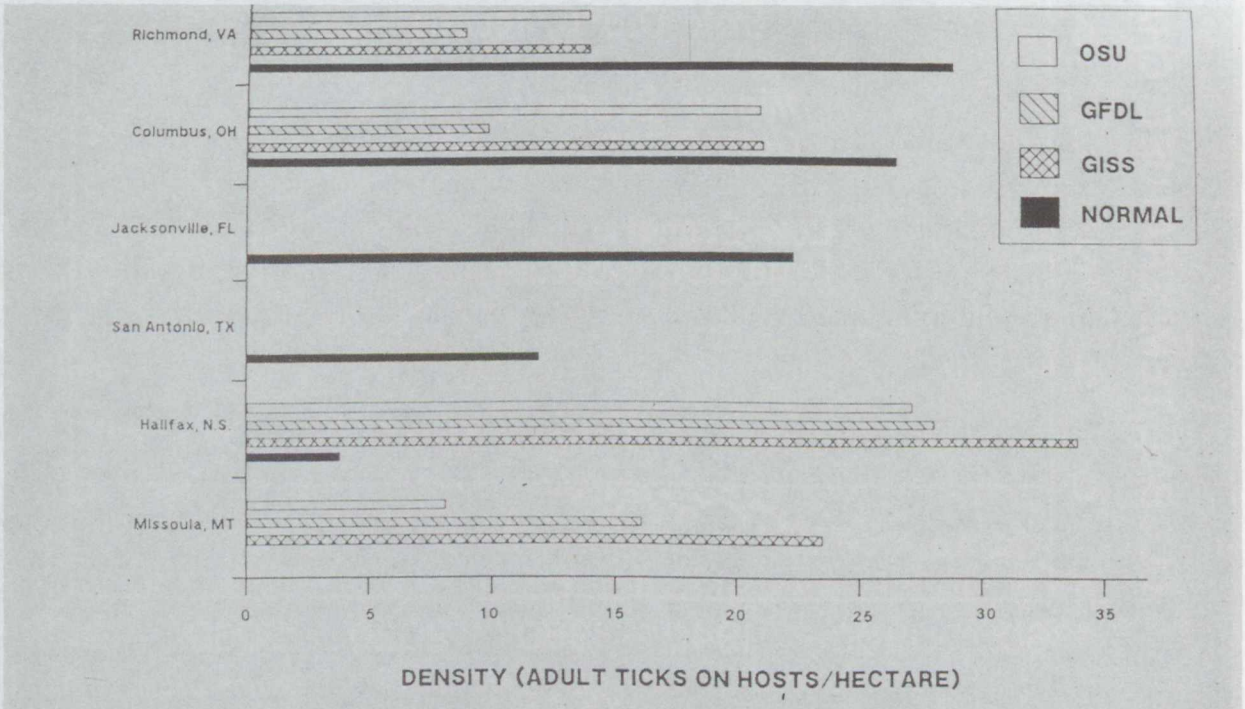


Figure 14-7. Simulated tick densities for selected cities under various scenarios of climate change.

Source: Haile. Volume __.

The Chairman: Thank you very much, Dr. Schneider. We will move to Dr. Jim MacNeill, Director of The Environment and Sustainable Development Program, Institute for Research on Public Policy, who will give a statement on the policy implications of climate change. Dr. MacNeill was educated at the University of Saskatchewan and the International Graduate School of the University of Stockholm. He served in senior positions in Ottawa, was Canada's Commissioner General to the United Nations Conference on Human Settlements, and was Director of the Environment for OECD before acting as Secretary–General of the Brundtland Commission.

Dr. Jim MacNeill (Director, Environment and Sustainable Development Program, Institute for Research on Public Policy): Echoing Stephen, I am delighted that eight parliamentary committees have come together to address the issue of global warming. This issue cuts across all of the sectors represented on your committees and has moved to the top of national and international agendas in a shorter period of time than any other recent issue.

I am also very delighted to be sharing this podium with Mr. Giguère and Mr. Miller, and my good friend, Stephen Schneider. Listening to them, it should be evident even to the most skeptical here that global warming will be one of the central issues of the 1990s. It could become the over–arching security issue of the next century. Most of you will recall that the International Conference on Climate Change, the changing atmosphere, held in Toronto a year ago last June warned that the ultimate consequences of global warming "could be second only to global nuclear war." It spoke of "potentially severe economic and social dislocation which will worsen international tensions and increase the risk of conflicts among and within nations".

As you heard from Dr. Schneider, there is a broad and growing consensus among the scientific community on this issue. I believe there is also a growing political consensus in many countries that the nations of the world simply cannot wait for total certainty and must act now.

What should we do? What are we starting to do now? How long before we see an international agreement? What form might it take? Perhaps most importantly, should we wait for an international agreement before we begin to act?

I have been asked to give you my view of the answers to these questions. I am going to begin with action at the national level. I will then look at some of the options for international co–operation that are being considered.

I already mentioned the Toronto conference. It was really quite a remarkable conference because it brought together ministers and scientists—like Stephen, he was there—public officials and industrialists, economists and environmentalists. There were some 300 in all from 46 countries, and it brought them together in a surprising consensus.

Toronto's main conclusions have since been confirmed in a steady stream of national and international meetings, all leading up to the second world climate conference, which will be held in Geneva in November of this year. I think some of you were there. You will recall that Toronto said that governments must agree to stabilize atmospheric concentrations of carbon dioxide. That must become the overriding goal for action on global warming.

Now, obviously this goal cannot be achieved overnight—among other things, it involves reducing emissions of carbon dioxide by between 50% and 80%—but it can be achieved in stages and it can be achieved through measures that are aimed principally at four targets.

Let me go through them quickly. The first is to eliminate completely the production of ozone destroying CFCs, which, as Stephen has told us, are also a major greenhouse gas. The second is to reduce energy-related emissions of carbon dioxide in agreed stages with the brunt of this reduction to be borne by the industrialized countries—indeed, I would think all of it. The third is to halt deforestation, and the fourth is to offset the remaining emissions of carbon dioxide by extensive reforestation or aforestation.

I should mention that reducing fossil fuels will also reduce nitrous oxide and methane to some extent, but I should add—Stephen underlined this in his pictures—that no one is really yet in a position to suggest measures to deal with the much larger agricultural sources of methane.

I can already hear the sceptics in the audience murmuring two things: one, it is simply not possible to take these measures; two, even if it were, no government could justify doing so as long as the science of global warming is uncertain.

I hope to demonstrate in a few minutes that it is possible to take these measures, and indeed a number of countries have already started. But I suspect that it is the uncertainties that bother us most.

Dr. Schneider has dealt with this in one way; I would like to deal with it in another. First of all, I would like to say that environmental issues—and this is especially true of issues like acid rain and global warming—seldom come wrapped in certainty. During my years in OECD and with the Brundtland Commission, I learned that he who lives by the crystal ball must learn to eat ground glass. There must be a few others in this room who have often enjoyed a diet of the same substance. After all, most of the issues on which parliamentarians take decisions every day are marked by even greater uncertainty than global warming—the economy, trade, human rights, foreign policy, you name it. But for some reason politicians have always demanded a much higher level of certainty before acting on the environment than on almost any other issue.

I do not mind telling you that the uncertainties surrounding these issues plagued the Brundtland Commission throughout its entire life. Apart from agonizing over it, how did we

deal with it? The most useful approach we found was to consider action on these issues as a form of insurance. Given the potentially catastrophic consequences of ozone depletion, global warming, deforestation, species loss, soil erosion, and all the other issues with which we were dealing, the cost of insurance against them is not large. The uncertainties surrounding military security, for example, are much greater, yet nations spend colossal sums to buy insurance in the form of men, materials, and highly uncertain technologies.

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Insurance against global warming is especially cheap when you consider that the most cost-effective measures to deal with global warming are also the most cost-effective ways to deal with acid rain, air pollution, deforestation, and many other issues of more immediate concern.

Moreover—and I think this is very important to underline here—up to a certain point many of these same measures are sound investments in their own right. They cut energy bills and increase the nation's macro-economic efficiency and international competitiveness.

So even if climate change turns out to be less severe than now feared, the insurance will pay for itself. We have to consider the possibility, as Dr. Schneider underlined, that climate change will be much worse than the models predict. In that regard, I think we should remember the ozone hole.

Uncertainty is not a reason for inaction. Inaction can be the most risky of all strategies. A World Bank paper on the issue recently stated:

When confronted with risks which could be menacing, cumulative, and irreversible, uncertainty argues strongly in favour of prudent action and against complacency.

What kind of prudent action? Well, a broad consensus is coming together around the four principal strategies I mentioned. I have them on a chart for you; I will see if this machine will work for me.

Let me say a word about each of these in turn. You will find that the principal strategies are at the bottom of the chart. First of all we can look at ozone and CFCs.

Toronto agreed that the first order of business was to ratify the Montreal Protocol on ozone. As you know, it has since come into effect. Negotiations are now underway to strengthen it, to ban all CFC production by the year 2000.

There is to be a meeting of the contracting parties in London at the end of June to amend the protocol. If—and this is an important "if"—it is strengthened and if it is implemented without leakage, it could result in up to a 20% decrease in global warming trends. So this is a very important meeting coming up in June.

But there are major obstacles. A few large developing countries, China and India among them, have stated that they are simply not prepared to give up the use of CFCs just at the moment when they can begin to contemplate a simple refrigerator in every home.

This is unless and until the Western industrialized nations agree to deal with certain issues such as preferential access to the technology required; special measures to bear the costs; and some other very difficult equity questions—and to deal with them in a meaningful way, something that we in the Western World have never yet been prepared to do.

Let me take deforestation and afforestation next—they are the last two on the chart—not because they are more important but because they may appear to be somewhat easier. Deforestation releases substantial volumes of carbon dioxide—I think Stephen used a figure of 20%—and it is therefore a major contributor to the greenhouse effect.

I think it is very interesting that the northern media tend to focus on deforestation in the South, especially in Brazil and Indonesia and other tropical countries. In fact, deforestation in the north, both in the west and in the east, is a very serious problem. Given the frightening trends in forest kill by acid rain in Europe, it will get much worse—much worse, in fact—before it gets better.

A lot of the articles about deforestation seem to suggest that it is sort of inevitable, poor people climbing over the forests, no options, that sort of thing. It is almost an act of God. Well, it is not. It is most often the direct consequence of government policies. In our work in the Brundtland Commission, we found government policy cupboards all over the world are full of incentives to overcut the world's forests.

.1215

Brazilian taxpayers underwrite the destruction of the Amazon to the tune of hundreds of millions every year in tax abatements for uneconomic enterprises. The Indonesians do the same. American taxpayers are subsidizing the clearing of the Tongass, the last great rain forest in Alaska. In Canada, I wish, Mr. Chairman, somebody would produce the figures.

If these incentives remain in place, in my view it is very doubtful that the world's remaining forests will survive. Removing them will not be easy. I remember at the Toronto conference—I think Stephen will remember this too—the Indonesian minister of environment was asked why, if deforestation was not in their interest, as he said, they do not simply stop it? His reply was immediate. He said every year these trees provide them with $2.5 billion in foreign currency that they need for their development. If we can provide them with an alternative, they would be very interested.

That is what it comes down to. If the western world wants to stop deforestation, we must not only put our own house in order, eliminating our own perverse subsidies and setting aside at least 12% of our territory in reserves; we must also be prepared to link proposals to stop deforestation in southern countries with the things they need for their development—for example, preferential access to technologies, debt reduction, debt-for-nature swaps, trade access, eliminating the sugar quotas, and many other things.

The burning of fossil fuels adds carbon dioxide to the atmosphere, but the growing of trees and other forms of biomass will take it out, and the potential to reduce atmospheric concentrations of carbon dioxide is quite significant. Two western countries, Australia and the United States, have recently announced a start on massive programs to replant forests and to plant trees on marginal lands and wastelands. The private sector has also got into the act. One American company, you will be interested to know, has decided to support an aforestation project in Central America to offset the increased carbon load its new coal-fired power plant will place on the atmosphere.

In my view, all major power utilities should do the same thing, including all our provincial utilities here in Canada. If the costs are added to the price of electricity, the consumers will bear their share of the cost of preventing further global warming and acid rain and air pollution. This idea could also be linked to our development assistance programs and our debt reduction programs.

These three strategies are vital, Mr. Chairman, but the most important by far is the second on the chart: reducing energy-related emissions of carbon dioxide. Any realistic strategy to do it must begin with the fact that one-fourth of the world's population accounts for nearly 70% of all carbon emissions from fossil fuels. This wealthy, energy-intensive, one-quarter of the world must lead the way, and the two nations occupying the North American continent should be at the head of the pack, with Canada in the lead.

I attend a lot of international meetings. I am often reminded by my foreign friends that we are the energy guzzlers of the world. North Americans consume more than twice as much energy per capita and per unit of product than Japan and most west European countries. In the process, we produce more acid rain and more global warming. On atmospheric pollution, Mr. Chairman, we are the environmental bad boys of the industrialized world, and the rest of the world knows it. When I hear statements that we in Canada are world leaders on the environment, I cringe with embarrassment.

.1220

Every country, every province in Canada, and every state in the United States has a different energy mix and will thus go about reducing fossil fuel consumption in different ways, but the most cost-effective strategy is open to every country, developed or developing, which is to rapidly increase the energy efficiency of homes, vehicles and industries. Beyond that, we will have to gradually shift away from fossil fuels with a high carbon content to fuels with a low carbon content, such as natural gas, and will have to switch to renewables and other non-fossil fuel forms of energy. I have summarized these strategies on another chart.

The potential to reduce carbon emissions through energy efficiency measures is quite enormous. Global carbon emissions are presently estimated at between five and six billion tonnes a year. Looking ahead twenty years, some studies suggest that energy efficiency

improvements alone could make a difference of three billion tonnes in the amount of carbon dioxide released into the atmosphere in 2010.

No other strategy offers as great an opportunity to limit emissions over the next two decades. We also know from real experience that we can achieve a steady annual increase in energy efficiency without sacrificing necessary growth.

Between the first oil shock in 1973 and the year 1985, the OECD nations improved their energy productivity by 1.3% annually, on average. The star performers were Japan and a few European countries. Japan secured a remarkable improvement of 31% during that period and the West German economy gained 23% in energy efficiency. By 1985, these countries, along with Sweden and a number of other countries, were increasing their energy productivity by more than 2% to 3% per year.

It is interesting to note that these same countries are at the top of the list of international economic performers. They not only reduced the energy content of every unit of production, but they also increased the efficiency of their economies and the competitiveness of their industries.

Canada was unfortunately not one of the leaders. We gained about 6% over 12 years, which is about the same rate as Australia and we use twice as much energy to produce a dollar of GNP today as Japan. Every Japanese import to Canada and to the United States has a 5% cost advantage because of its lower energy content alone.

A large number of studies available to us, on the Brundtland Commission and many more that have come out since, document this efficiency revolution in vast detail and show how efficiency has become an energy reservoir as large as the oil fields in the Middle East or the untapped hydro sites of James Bay. If we are to tap this reservoir, the western world will have to lead the way and this will require a number of new policies. I want to mention four of them by way of illustration and have shown them on a chart.

The first policy relates to energy pricing and introduction of some form of carbon tax. The second relates to removing subsidies to the fossil fuel industry, which promote the very opposite of what is needed to reduce global warming, or acid rain, for that matter. The third covers mandated energy efficiency standards and labelling. In fuel economy, the automobile industry is now looking at 75–mile–per–gallon performance. For household appliances and lighting, fluorescent bulbs alone could cut lighting energy use by 75%, standards for industrial motors, new buildings, and so forth would be included. The fourth policy is regional adjustment programs for those sectors that will bear the brunt.

.1225

Before you react too much to this, I would like to show you another chart in which I have listed those countries or some of them that have already decided to move in these directions. I have three charts. That is just the first five countries.

The efficiency gains between 1973 and 1985 were driven mainly by higher energy prices, although in some big gainers like Sweden regulated efficiency standards played an

important role. The Brundtland Commission, you will be interested to know, recommended that nations adopt what we call conservation pricing. It implies that governments should use taxes to maintain energy prices at levels high enough to sustain significant annual increases in energy productivity, and that points clearly in the direction of a carbon tax.

Some argue that a carbon tax can be introduced only within the framework of an international agreement, but as you can see from the chart a number of countries have decided to proceed unilaterally with such a tax or they are seriously considering it. That is Finland, Italy, Norway, and Sweden, among others.

I do not need to tell an audience of Canadian parliamentarians, at least certainly not at this point in our history, that there are always serious political barriers to new taxes. But judging from the experience elsewhere, these barriers are not insurmountable. As we heard from Mr. Miller, polls in Canada and in many other OECD countries indicate that voters are prepared to pay environmental taxes provided—and I believe this is a very important priviso—that the revenues are in fact dedicated to environmental improvement.

Something else I think should be stressed is that carbon taxes and environmental taxes in general do not have to increase the overall tax burden. They can, and in my view they should, be matched by an equivalent reduction in taxes on income, savings and investment. Moreover, this reduction could be graduated so that lower-income groups would be compensated for the higher prices they would have to pay for energy and energy-intensive products. This you will be interested to know is the direction in which the debate is going at the moment in West Germany; if my information is correct, and I think it is, we can expect to hear some interesting announcements from West Germany in a few weeks.

With so much interest in environmental taxes in Europe—and you have seen both charts—you will be interested to know that both the European commission and the OECD are beginning to examine guidelines for them.

It would obviously make no sense whatsoever, Mr. Chairman, to introduce a carbon tax to reduce emissions if at the same time we do not remove subsidies to the fossil fuel industry, which serve to increase them. Europe subsidizes coal, as you know, and the United States and Canada subsidize all fossil fuels. A recent study of the situation in the United States found that total U.S. subsidies to conventional sources of energy development amount to more than $40 billion U.S. dollars a year. That is more than $50 billion Canadian. Other studies I have seen suggest that is a very conservative figure. I cannot find a figure for Canada, but I would guess it is probably more or less proportional.

Mr. Chairman, there is plenty of room for unilateral action to reduce emissions. In my view the western countries have to get their own house in order before they can lead or become credible partners with countries in the east and in the south. That is the real challenge on global warming, because in the final analysis no country or group of countries can expect to achieve these goals and targets single-handedly. The OECD nations account

for only about 40% of total greenhouse gas emissions, so even if it were possible to eliminate all of them—and obviously it is not—it would not solve the problem.

.1230

Southern countries are now responsible for less than one-quarter of all fossil-fuel-based emissions. But combining their projected population growth with their legitimate economic aspirations could result in a four or fivefold increase in bare energy use in a few decades.

I should mention that with falling oil prices energy demand jumped 3.7% last year and 2.8% the year before. The International Energy Agency predicts that if current low energy prices are maintained, 5 years into the next century the world will be burning not 20% less fossil fuel, but 50% more than it was burning in 1988. And those figures, in my view, are the building blocks for global disaster.

What scenarios for international co-operation appear to hold the most promise for real action? There are many schools of thought on this question, but given the time I will mention only three. The first is a pluralistic approach that would seize opportunities for concrete action as they arise, bilateral action and action by small groups of self-selected countries in the north, the south and the east. The second is international conventions involving all nations, and the third involves major reforms of the international system.

Why small bargains involving a few countries? Mr. Chairman, our track record on big bargains involving all countries is not very good. These issues are extremely complex and tensions, especially north-south tensions, are increasing dramatically. Some developing countries have clearly come to the conclusion that the wave of environmental concern sweeping Europe, North America and Japan provides them with political leverage, however negative, that they can use to bargain for action on the things that concern them most, such as development funding, trade access, preferential access to technology and so on. And this is evident in the negotiations on the Montreal Protocol, it has entered the negotiations on climate change, and it was evident recently when the general assembly debated the proposal to hold a conference in Brazil in 1992.

So we need small bargains to build confidence and develop a track record of experience on both sides, north and south. The funding for these bargains is very important and perhaps I can go into that during questioning. A number of proposals have been put forward, and as you saw from my chart countries such as Norway and the Netherlands have already decided to commit substantial funds for this purpose.

The other approach is to move directly into an international framework convention. Work on a framework convention is going ahead through UNEP, WMO and the Intergovernmental Panel on Climate Change, the IPCC. If you like I will try to deal with the question of the international negotation on a framework convention during the questioning.

Finally, I would like to say that the massive changes occuring in the relationship between the world of nation states and the earth and its biosphere have not been accompanied by corresponding changes in our international institutions. A number of proposals are on the table. I will mention two or three and then conclude.

The Hague declaration of last March recommends a new international authority with responsibility to prevent further global warming. The authority would have the power to impose its decisions on sovereign states, and appeals against it rulings could go before the International Court of Justice.

.1235

Other proposals concern reform of the major policy and co-ordinating organs of the United Nations. It has been proposed, for example, that the Security Council should periodically devote a special session to environmental threats to peace and security.

Others have suggested a new earth council, equal in authority to the Security Council but perhaps without the right of veto. The trusteeship council, as you know, is coming to the end of its mandate. Another proposal would transform it into a forum in which the nations of the world could exercise their trusteeship for the integrity of the planet as a whole, including the global commons in the atmosphere.

This menu of options can be expected to grow rapidly over the next couple of years as we go through the conferences that I have mentioned.

Ladies and gentlemen, the environmental issues are beginning to reshape national and international affairs. They may well become the seminal issues for the next century. Public opinion, as we have heard, is far ahead of government on these issues. In my view, global warming alone will ensure that it stays there. The politics of greening I believe will continue to drive the greening of politics well into the 21st century. Thank you very much.

Global Goals and Targets for Global Warming

Global Goal:

- **reduce emissions of carbon dioxide by 50 to 80 percent in agreed stages.**

Toronto Target:

- **a 20 percent reduction over 1988 levels by 2005, with the brunt of this reduction to be borne by the industrialized countries.**

Principal Strategies:

- **eliminate production of ozone–destroying CFCs;**
- **reduce energy related emissions of carbon dioxide in agreed stages;**
- **halt deforestation;**
- **offset the remaining carbon dioxide (or CO_2–equivalent) emissions by extensive reforestation.**

Proposed Strategies for Reducing Energy Related Emissions of Carbon Dioxide

- **Increase energy efficiency at rates of 1-3 percent per year.**
- **Switch from high carbon to low carbon fossil fuels (e.g. coal to natural gas).**
- **Switch to renewables and non-fossil fuel forms of energy.**
- **Provide developing countries with preferential access to energy-efficient technologies, and financing needed to put them in place.**
- **Link international agreements with other issues of primary concern to developing countries: e.g. trade access and debt reduction.**

Strategies to Increase Energy Efficiency

- **Energy pricing—the introduction of some form of carbon tax.**
- **Removing subsidies to the fossil fuel industry.**
- **Mandated energy efficiency standards and labelling.**
- **Regional adjustment programs for those sectors that bear the brunt.**

National Climate Change Policies Enacted or Proposed (1)

Nation	Policy	Status
Australia	**National Afforetation Program**	**Effective 1990**
Finland	**Freeze on CO_2 emissions by 2000;**	**Proposed: Cabinet Tax approval**
	Carbon Tax 0.68 cents/kilo CO_2	**Effective Jan 1/90**
	Other Environmental Taxes	
Italy	**Tax on fossil fuels**	**Proposed: Cabinet approval**
	Other environmental Taxes	
The Netherlands	**Freeze on CO_2 emissions by 2000;**	**Proposed: Cabinet approval**
	Carbon tax	Ditto
	Commit $125 Million to World Environment Fund	
Norway	**Stabilize CO_2 emissions by 2000;** then reduce emissions	**Approved by Parliament, June/89** Whitepaper
	CFC tax	**Effective July 1/90**
	Increased taxes on gasoline	Ditto
	Commit 0.1% of GNP to World Environment Fund, if some other nations do the same	

National Climate Change Policies Enacted or Proposed (2)

Nation	Policy	Status
Sweden	**Freeze on CO_2 emissions at current levels**	**Approved by Parliament**
	Value-added tax 23.46% on energy fuels	**Legislation April, 1990**
	Carbon Tax 4.8 cents/kilo CO_2	Ditto
	Rebate **Tax on nitrous oxide** emissions by large power plants	Ditto
	Tax on sulphur emissions of coal, oil and peat C$5.53/kilo Sulphur	Ditto
United States	**National Afforestation Program**	**US Budget Fiscal 91**
	Comprehensive emissions to cut carbon emissions by 20%	Several bills pending in Congress
West Germany	**Proposed tax on oil with compensatory reductions in income tax**	**Before parliamentary commission**

State/Local Climate Change Policies Enacted or Proposed

State	Policy	Status
California	Comprehensive policy under development	Government report to legislature June, 1990.
New York	**20% reduction in CO_2 emissions by 2005**	State energy plan approved to reduce state's energy intensity by 2.5% per year.
Oregon	**20% reduction in CO_2 emissions by 2005**	Law enacted July, 1989.
Toronto	**20% reduction of CO_2 emissions by 2005**; through program of emission reductions, reforestation projects and strategies to adapt to warmweather.	Approved by resolution of council. $23 million in new funds committed. In the end, probable dependent on Ontario Government support.
Victoria Australia	**20% reduction in CO_2 emissions by 2005**	Cabinet approval.

The Chairman: Thank you, Dr. MacNeill. We are now at the point of answering questions. We have a limited time, because I did say that we wanted to end at 12.55 p.m.

I have five questioners here. This will not represent every committee, but I would ask the questioners to identify themselves and to ask a short question. I would ask that the answers be reasonably brief as well.

Mr. Foster (Algoma): We had a very stimulating and informative presentation this morning. Mr. Giguère, Mr. Miller, thinking back over the last 20 years around the House of Commons and the Parliament of Canada, I recall that in the 1968 election there was not a word about the environment. Two years later, practically every country in the world and every government in the world was establishing a Department of the Environment in 1969–70. Later in the decade, in the late 1970s, I recall that we suddenly became very conscious of the whole problem of acid rain. We established a committee, we had public hearings across the country.

Public opinion seems to be very, very strong now on the concerns with the environment. In looking back over your data and polling in the early 1970s there seemed to be a rise of concern and then a dropping off.

Are we really dealing with a completely new global consciousness of the environment—in which case it is much easier for parliamentarians and politicians and governments to take action—or are we going through a blip in public interest and public concern? I wonder if you could give us your opinion on that.

Mr. Miller: I think Mr. Giguère's values–based research on this is very important to set the setting. This is not going on in and of itself. There is a setting of changed values; he outlined very well that it is happening.

In terms of research on the environmental issues, what we find is that over the last decade the issue has been fundamentally redefined. So what we are talking about today in terms of the environment is not what was meant 20 years ago or 10 years ago. Then, it was an aesthetic concern out there; today, it is a health issue in here. It is a planetary survival issue that we all have a role in. So it is a fundamentally different issue; that is the first point.

The second point is that given that it is hinged upon the central underpinnings of changing values in this country, it is not going to go away without action to address it. It is not something that is going to be a blip in public opinion. It is not something that is being driven by policy–makers or the media or anything. It is coming up from below. While top of mind, the issues of the day move it around. It will be a lasting issue very clearly through the 1990s.

.1240

Mr. Stevenson (Durham): On the growing scientific consensus, Dr. Schneider, are you and various others using static models or do they change? For example, as carbon dioxide increases, the photosynthetic rate is also likely to increase. Are these sorts of things taking

carbon dioxide into account and what effect does temperature have on the carbon dioxide sink in the oceans and so on?

After this, would you very briefly comment on the recent NASA information that took away some of the momentum from the growing concern about the global warming.

Dr. Schneider: Those are good questions. Let me do the last one about NASA first, because that is actually very easy. I probably expressed an obvious degree of exasperation with the public debate on this issue by saying it frequently did not reflect the scientific debate.

The question with NASA is a classic example. NASA is not an agency that has discussions or opinions on global warming. Individual scientists do. The strongest radicals are in NASA as are some of the biggest attractors. This was one group of NASA who were not knowledgeable about climate systems but about developed satellite instruments.

They developed an instrument and used it for about a 10–year period to look down from space into the atmosphere to try to sense what the temperature change. I approve of this kind of measurement because the temperature records I showed are thermometers at the surface where we live. Those are the important numbers we need, but they are flawed by a variety of problems having to do with thermometers moving from city centres to airports and so forth which makes the debate about what the actual temperature is sometimes heated.

Nevertheless, having the satellite there would be helpful. The problem with the satellite measurements is that they do not measure the surface temperature, they measure the temperature in the middle of the atmosphere, so they are not a perfect replica.

Nonetheless, many of us were surprised that there was a very good correlation reached over the 10–year record from about 1978 to 1987—I forget the exact dates—that showed a rapid warming with very warm years in 1980, 1981, for example. After the eruption of El Chichon Volcano in 1983, there was a cool period in the middle of the 1980s. The warmest two years on the record were 1987 and 1988. The satellite measurements did indeed show that, which was completely coincident with what the surface network showed. My conclusion from this, and that of most scientists, was that this therefore confirmed rather than denied what we already knew.

The problem was those scientists made one statement in a long paper that was grabbed out of context. They said that over the 10–year measurement period there was no global–warming trend. No responsible scientist would ever argue that we are going to see a warming trend in a decade.

We are talking about nature fluctuating on the order of several tenths of a degree Celsius in a decade, which indeed it did. That up–down–up was already known to us from the surface network. What many people in the media misinterpreted was that since there was no trend over the decade, therefore there was no warming trend. This is nonsense. The

100-year-long record that shows the 1980s as the warmest decade could not possibly be confirmed by a record that began in 1977. It never did any measurements before then. What it confirmed was this up-down-up, which suggested even more strongly that our thermometer record was accurate. This has not been conveyed.

In general, people should not listen to the latest study as proving or disproving anything, because the context is very hard to get. That is what we have deliberative bodies for. That is why there is the Intergovernmental Panel on Climate Change and the National Academy of Science Studies and so forth. They are a rather good source for sorting out this fluctuation from study to study and trying to put some perspective on it.

This study was well known to the IPCC, and it had no effect on their conclusions, because, if anything, it strengthened rather than went against the conclusion. Yet there was a media blitz in the opposite direction, based essentially on a false premise—that there was no warming, when they were only talking about a decade and had not measured the long term.

.1245

The other question you asked—whether the models include the potential feedbacks—is I think much more fundamental. The answer is they do to some extent, but not nearly to the extent most of us would like. The kinds of feedbacks they include are clouds and sea ice, for example. They do not explicitly include the feedbacks—that is, the climate models do not—on the carbon cycle, in which an increase in carbon dioxide would lead to an uptake in carbon in the standing crop of the biosphere.

So one could legitimately argue that the scenarios we run suggesting certain rates of carbon dioxide may be too fast. One can argue equally persuasively—I would even argue more persuasively—that what they do not include is as likely to make the estimates worse as it is to make them better. There is more carbon in the soils, dead organic matter, than there is in the trees. There is about the same amount of carbon in the trees as the air.

The carbon in the soils ends up in the atmosphere as either carbon dioxide or methane, because microbes in the soil decompose it. They take decades or centuries to do it. If you clear off land and remove the vegetation cover, the soil gets warmer. If you increase the global warming through carbon dioxide and methane, the soil presumably also gets warmer. Bacteria operate metabolically more efficiently when they are warmer. Therefore, over the long term we could substantially increase the rate at which these bacteria decompose soil organic matter, thereby having a strong enhancing feedback. That too is not included yet in the models, which is why we always show such a wide range—a factor of three or four, ranging from mild to catastrophically serious, because the kinds of issues you mentioned are not explicitly included. As to the one you want to gamble on in the future, that is what it is: a gamble.

Mr. Benjamin (Regina – Lumsden): I can not help but comment, on going through the book, that at least four of the panelists are educated in Saskatchewan. We are proud to see that kind of contribution from my province being made to this world-wide effort.

I will have been a Member of Parliament for 22 years in June. I have served that full-time on the Standing Committee on Transportation. Mr. Miller, you made a comment I wish you had not made in the matter of constitutional jurisdiction. That has been the frustration and the most maddening part of being a Member of Parliament—seeing all three levels of government arguing about jurisdiction. Yet we have countless examples of national standards being set by the national government for the last five or six decades, and as long as there was some money in it the provinces and the municipalities were only too happy to join in. I wish you would just reverse that. Do not encourage them to use it as more excuse not to act.

Transportation, such as automobiles and trucks and planes and what not, is probably one of the larger contributors to air pollution. About 14 years ago a colleague and I submitted a paper, which was published by Guelph University. There are 100,000 miles of railway lines in Canada. If you electrified the 10,000 miles that carry 75% of the traffic, and we could complete it by the year 2000, the amount of diesel fuel and other fossil fuel you could transfer from transportation to food production and heating homes would be the equivalent of seeding and harvesting twelve crops in the three prairie provinces in one year. Everybody says it is a good idea—cannot get it done.

Every time it is raised in the Transport Committee it is going to cost too much money. Surely that is an area. Plus, once having done that, you provide a change in tax laws and other freight rate incentives, so that tens of thousands of tractor trailers are loaded on flat cars and hauled any distance over 200 miles and taken off the highways. Surely it is a major contribution to fossil fuel. I would like your comments as to what you think about it or whether you have done any studies on it. What do you know about it?

The Chairman: Is there anyone you would like to direct that to, Mr. Benjamin?

Mr. Benjamin: Well, Mr. Miller might want to comment on that.

.1250

Mr. Miller: On the jurisdictional question, it is clear from my research that Canadians are looking to the federal government for leadership because they recognize the trans-boundary nature and the magnitude of the problem and they look to the largest amount of resources that exists. I did not intend it as a filibuster or anything of that kind, but I was just commenting on perception.

Secondly, the trend appeared from our research that the transport sector is not generally a recognized contributor to environment problems during the 1980s. That is again an entire public education process, to be established. As to your specific suggestion, I do not know.

Mr. Benjamin: We have 13 jurisdictions.

Dr. Schneider: Whether or not electrification is a good idea from the global warming point of view depends on whether the source of that electricity generates more of the pollutants than do automobiles and trucks.

It would be a question of how you are going to do it and if you could do it with more efficient kinds of plants than trucks. Then it would be a good idea from the warming point of view alone. If not, it would be....

Mr. Benjamin: The source would then be hydro-electricity in Quebec and Manitoba.

Mr. Caccia (Davenport): Listening to Mr. MacNeill, I suspect you also wish our colleagues from the committees on finance and external affairs could be here to hear what you have to say on energy pricing, taxation and international co-operation.

My question relates to the equation Dr. Schneider referred to; namely, that the total carbon dioxide emissions equation is quickly expanding, particularly on the ratio of technology per capita, which is an intriguing concept. Would you also indicate whether the role of the ocean is included in that equation?

The Chairman: Before you answer the question, the external affairs committee wanted to be involved, but could not be here.

Dr. Schneider: In that particular equation, which we would call an identity, total production of carbon dioxide is equal to a product that returns to cancel out carbon dioxide. With regard to the role of the oceans, they are not included because the place to include them is in the forecasts of how a given change in carbon dioxide that is injected into the air remains in the air. That is critical for the oceans and indeed reflects the kind of uncertainty the gentleman asked about before.

That aspect would be included in the forecasts in future. The statement on total emissions was given on an annual basis and related to how much is injected into the air. The oceans do not initially get into that act, but rather in determining what is injected, how much is injected, and how much remains.

On the per capita question, as Jim MacNeill said, if you look at countries such as China, Indonesia, and so on, their per capita use of carbon dioxide in technology generally is very low. Indeed, that is part of the low standard of living. At the Toronto meeting, which I and a number of us attended in 1988, there were substantial complaints from third world countries and we will continue to hear them. The countrie are so low in per capita terms that they are not the first people to look to in order to help solve this problem.

My own view is that the population multiplier tells us we certainly do not expect them to solve that problem in the middle term, in technology per capita terms. In fact, they probably have to increase that term.

But whatever infrastructure the Chinese, for example, lock in now in energy production over the next 30 or 40 years, it will remain for 30 or 40 years. Given that the state

of the art in efficiency for coal-fired plants is approximately 45%, and from 50% to 52% for combined-cycle gas production, it would seem very foolish from a global point of view to have the Chinese install power plants with 30% efficiency, which are cheaper, and for which technology is readily available. You then have to look at 40 years of increased operating expenses and we will have to live with 40 years of increased emissions.

.1255

It is part of the bargain to which Jim MacNeill referred, to see that whatever they do to increase their technology per capita—their standard of living—is taking advantage of the first term of that equation and getting the least emission and the highest technology available, least emission now so that we have less total effluent over that period of time. That probably will mean higher first costs. Even if it is lower costs over the total operating cycle, which I think is easy to show, you still have to have the capital before you can invest it. That is where we will need bargaining between developed and developing countries.

Mr. Fulton (Skeena): I have a short question for both Jim MacNeill and Dr. Schneider.

Studies have been done in Canada by the DPA Group and others, indicating that we can get two-thirds of the way towards a 20% reduction in carbon dioxide by the year 2005 at a $5,000 per capita saving to every man, woman and child in Canada. Similar studies have been done in the United States. Knowing that, what is going on? I think the public really want to know just in terms of this weekend. We have President Bush trying to kick the slats out of the scientific evaluations that have been done in terms of global warming. Here in our own country, every single energy minister has attempted to distance himself from the DPA report without ever even having evaluated it for its technical value. Here in our own country, the minister of energy is suggesting that people might have to give up their motor vehicles in order to achieve the 20% reduction. I would like to hear the remarks from both of you in terms of what is going on. I think the public is really troubled by that.

Dr. MacNeill: It is a good question. The DPA study, which was undertaken for the federal and provincial energy ministers, has been confirmed in other countries. It has been confirmed by similar studies in West Germany, Sweden, Norway, Finland, and the Netherlands. Many other countries are doing their homework on it now.

What is going on is that those countries—there are many of them, you saw them on the chart—have decided to move. They have decided to move in increments. None has so far bitten the bullet on the full 20% target, the Toronto target. But the Netherlands, Sweden, Findland and Norway, for example—I think West Germany is going to go further in a few weeks—have decided already to establish a target of a freeze by 2000 of 1990 levels. They are going to roll back to 1990 levels by 2000. They can do that at substantial savings to their energy consumers, to their householders, their transportation systems—a significant increase in the efficiency and competitivity of their economy. It simply makes good economic sense to do it. They do not have to wait for an international agreement, it is something they should do anyway. And they have decided to do it.

At the same time, they have sharpened their pencils and they are doing some further work on the policies that will need to be put in place in those countries in order to move from a freeze target to the 20% by 2005 target that Toronto recommended. I understand that in West Germany they have already done that homework and I am told it is very likely that they will go directly to the 20% target.

What is happening in Canada? You are the politician. You tell me. I think there is not nearly the appreciation of the studies and the implications of the studies by the Canadian public or perhaps by the Canadian Parliament as there is by some of the overseas parliaments I have mentioned. I hear it often said in conversations with senior people in Canada that reducing the energy content of our growth will result in lower growth, will result in job loss, will result in all kinds of economic bads. This is not true, but a surprising number of people believe it. In fact, as I have just said, the opposite is true.

Dr. Schneider: People live a myth about economics. The myth about economics is that we are all rational operators and every investment we make optimizes what we do. That myth is obvious in your own house. I will bet that if you go there and you look around, you probably have a lot of incandescent lightbulbs. They cost about 50¢ a piece for say a 75-watt lightbulb. You can go out now—and it may be a little bit of an effort to find them, but some of the stores are beginning to carry them—and buy a lightbulb that is only 13 watts, a compact florescent that you screw right into the socket. It costs $10. It costs 20 times more, so the sticker shock drives people away. They figure you must be crazy. If you read it carefully you find that this lightbulb lasts 10 times as long, so you have to buy 10 of the 50¢ lightbulbs to have light the same length of time. But that is only $5, so you are still a loser. If you are in business, you have to pay somebody $10 an hour to screw those bulbs in. So if you weigh that time in, you are probably a winner already, plus you have to aircondition the building to get rid of the 75 watts of heat generated by the conventional lightbulb much more than you would have to air-condition it to get rid of the 13 watts.

.1300

The key is, you calculate the energy costs. Even at low energy costs, those $10 lightbulbs save at 5¢ a kilowatt hour something on the order of $50 over their lifetime. So you are ending up with a payback period of two to three years. That means an equivalent return on investment of about 25%, which none of us can get at the bank.

Why are we not doing this? Well, it is partly ignorance. We are—and this will come as a surprise to those of you in government—creatures of habit. I tried in my own house to get several of these fixtures installed and the electrician kept trying to talk me out of it. Why? He just did not know. Now that I have forced him to put in some sockets that work better with these things, he is sending people to my house to look at it.

We need to show people that what is actually economically rational may not be what they are in the habit of doing. That is part of the demonstration. The second problem is worse. There are power groups. You have organized groups that see themselves as losers in

this transition. They are fighting a very strong special–interest campaign against it, whereas the majority of winners, who in aggregate are the whole country, are not organized. So you end up with that subsidy problem. Subsidies are there for political protection, not for any other reason. Because we are not as economically rational as we think we are, we go on with habits that can be shown by study after study to be unwise. Yet we continue this way because it is politically rational for organized interest groups.

The Chairman: Thank you, Dr. Schneider, Dr. MacNeill, Mr. Giguère, Mr. Miller. It has been a great morning as far as I am concerned. We have set a precedent. I believe the level of awareness among everybody who was here has risen an awful lot. I think we have demonstrated to Canadians our concern.

The next session of this forum will begin at 3.30 p.m. in this room with the Committees of Industry, Science and Technology, Regional and Northern Development; Transport; and Energy, Mines and Resources.

This meeting is adjourned for the moment.

JOINT COMMITTEE SESSION I

Industry, Science and Technology,
Regional and Northern Development

Transport

Energy, Mines and Resources

AFTERNOON SITTING

.1536

The Co-Chairman: Order. The first witness we are going to have this afternoon is Dr. Digby McLaren. It is really a pleasure for me, as Chairman of the Standing Committee on Industry, Science and Technology, Regional and Northern Development, to welcome Dr. Digby McLaren as our witness here today.

Dr. McLaren is President of the Royal Society of Canada and a Professor of Geology at the University of Ottawa. Educated at Cambridge University and the University of Michigan, he has had a distinguished career both in the earth sciences and in the Canadian Public Service. He has published widely in the fields of palaeontology and regional geology and has been the recipient of numerous awards in recognition of his work.

During a 33-year career with the Geological Survey of Canada Dr. McLaren rose to become its director in 1973. In 1981 he was promoted to Assistant Deputy Minister of Science and Technology in the Department of Energy, Mines and Resources. He has since returned to academia, where he pursues his interests in geology, resource use, and global development. Welcome to our forum, Dr. McLaren.

Dr. Digby McLaren (President, Royal Society of Canada): Thank you very much, Mrs. Sparrow. I thought I would never be invited to this place again, after the last time I appeared before your committee. I am glad you have forgiven me.

I have a little job to do today. I have to tell you about the whole of global change in 15 minutes, as opposed to discussing climate change, and I was also supposed to bring a message in about industry. Well, a lot of what I say by implication affects industry, and in fact what I say affects all of us.

Viewed in the context of demonstrable global change, activities of humankind are currently taking place or have taken place recently that appear to be illogical or puzzling. Among recent activities you can mention, for instance, the strange story of the death of the Aral Sea in the Soviet Union through over-irrigation, where a beautiful lake, 400 by 250 kilometres, almost dried up and now has dust storms and sand dunes made of salt. The growth of the automobile in Europe is another one, where they now have traffic jams that last several days, yet they produce 15 million more of them a year. Half the trees in Switzerland, owing to car exhausts, are now showing stress and 15% are dead or dying. These are actual facts.

.1540

In addition, there are things like mining groundwater when we are over-pumping a reservoir. We know very well the reservoir will not recover when the pumping ceases. Or when we are over-irrigating and building up salts in the soil and we continue irrigation even after we notice the build-up; or factory farming practices when soil erosion is measurable and progressive desertification in many parts of the world due to human activity.

Such behaviour surely implies an incapacity to recognize that we live inside a sealed room with limited air and limited resources. It also demonstrates an inability to understand the phenomenon of geometric growth. The concept of global change is a unit, but this is not universally realized.

The core projects of, for instance, the International Geosphere and Biosphere Program do not include considerations of the driving forces of global change which are accelerating population and doubling exponential increase in energy use. Nor do the directors of the program make any gesture toward recognition of the overriding importance of the human dimension of global change.

There is a widespread tendency when discussing global change to equate it with climate change. No one denies the importance of climate change, and I understand you have had very good presentations on this already. But it is only one symptom of a large number of changes taking place as a result of human activity.

Many of these changes are already accurately quantifiable with reasonable degrees of certainty. There is also a puzzling tendency at the moment to play down the quantitative risk estimates that we make with regard to climatic warming. This is what you might call the "Bush syndrome".

The message in this talk is that global change embraces a very large number of phenomena, most of them easily observable and quantifiable. I do not wish to imply that we must declare ourselves as followers of what some people have called the "environmental craze", but I do suggest we recognize that although there are many opinions on how we should treat the future, most of them are put forward by people who are looking at only part of the problem and who offer only partial solutions.

The distorting factors of global ecology are many, but without doubt the largest are an accelerating increase in population growth and a comparable increase in the use of fossil fuels. Paul Demaine of the Population Crisis Committee was in Ottawa about 10 days ago and he pointed out that although the peak world population growth rate of 2.1% reached in the 1960s is beginning to fall, the main population explosion is still in front of us.

Absolute population figures show an increase from 50 million a year to 80 million a year from 1950 to the 1980s. This will reach 95 million a year by the end of the century. That means 95 million babies coming into the world every year. Stasis in the future is unpredictable—it depends entirely on our behaviour in the next ten years. After that, we are guaranteed an increase to about 14 or 15 billion, whereas if we took immediate violent and strong measures, although not particularly arbitrary measures, we could probably level off at about 9 or 9.5 billion. I am quoting UN figures, not my own.

Energy is involved either directly or indirectly in virtually every described manifestation of change. Currently, about 80% of all energy used by our species is derived from fossil fuels in one way or another. About 20% of the world population uses 80% of that amount.

Other accelerating manifestations of global change include rapidly growing destruction of the habitat of life, which has initiated a massive and irreversible episode of mass extinction. In the biosphere, the basis of the earth's ecosphere system, 25% to 50% of the world's species will become extinct within the next 30 years. We do not know how many different species there are—perhaps 10 million.

One should add to these forces the unimaginable expenditure of resources and human ingenuity on war and preparation for war. Notice in the forces listed above the recurrence of the word "acceleration". Many other examples of accelerating change might be mentioned—these are measurable and the acceleration is rapid. Destruction of forests, soil erosion—Bill Fyfe recently pointed out that this is one of the greatest natural disasters that might be and is affecting us. Once soil has disappeared it will not regenerate in human time spans of a few generations, if at all. Overuse of groundwater, all forms of waste production, solid, liquid and gaseous—all accelerating.

.1545

This means that one cannot talk about stabilization or equity, or use the term "sustainable development" while all of these influences are disrupting our home planet with most of them growing exponentially or greater. While this goes on, today's palliative measures will not be sufficient tomorrow. Sustainable development implies stasis, although its supporters still suggest growth, and they mean growth in an economic model with no limits—or they did. In the real world there is already a net decrease in resource availability and an increase in disrupting factors, and, as we see, these disrupting factors are accelerating.

There is little time to mention economic problems, but it should be emphasized that the economic subsystem takes resources into the system itself and excretes waste, in thermodynamic terms, with an increase in entropy, and is thus irrevocably and closely linked to the ecosystem. Input and output are finite, and the main variable is the one-way flow of matter-energy through our system. This raises the question of how long and how big the economic system should be in relation to the physical dimensions of the global system.

It also necessarily questions the concept of growth economics and the impossibility of generalizing western standards, and all that we use, to the world as a whole. Finally, in the light of the above it would appear to me that including sustainable development in a comprehensive action plan is highly desirable provided that it is realized that it will only be achieved in the Third World by increasing their capacity to use resources, including energy, while the developed world may find that, temporarily at least, there may have to an immediate reduction in resource use.

Under any scenario adopted, however, it is perfectly clear that population and energy are essentially involved in all problems and all solutions.

To round this out, where do ethics come in? In talking of the human environment and its immediate problems are we considering ethical problems, or are they merely common

sense, or are they enlightened self-interest? I believe all of these should operate and we should recognize the strong bonds between them. You can consider this a plea for common sense just as much as for ethics because they will both have the same objectives.

Global change has become the largest problem ever to face humankind. It will require massive adjustments to our way of life on a scale that is hard to grasp. The alternatives to rising to this challenge, however, are on a par with scenarios drawn from nuclear war.

I want to make a commercial for a book, and there are copies of this available to you, which will be published in three days by Oxford University Press, entitled *Planet under Stress:* The Challenge of Global Change. It is a wizard bargain book. It is subsidized. It sells for about $19 and it is worth about $80. Please get yourself a pamphlet.

The Co-Chairman: Thank you, Dr. McLaren. With that great push and publicity for the book, Charles and I have decided that if there is a minimum of at least three questions with regard to Dr. McLaren's presentation we would take them now, and then we would move on. Of course we would entertain general questions at the end.

Mr. Caccia (Davenport): As you noticed, Madam Chairman, Dr. McLaren made frequent reference to the fact that we are surrounded by a type of growth which he described as geometric. He certainly impressed on us the concept of acceleration in the patterns that are being clearly observed, the phenomena that he referred to, including the phenomenon of population expansion. His question asks how we should treat the future, if I understand him correctly. Since he does not seem clear as to whether or not the answer is sustainable development, which is a necessary intellectual and political framework to keep the global community together, I would like to ask him to define the sustainable development he has in mind against the background of the acceleration he has described. I would like him to go a little bit beyond his concluding sentences, in which he made reference to the immediate reduction of resource use in the north. This has enormous implications, since development would presumably still take place in the south. So I would ask Dr. McLaren to describe the future we should be envisaging against the background of applying sustainable development to an accelerated set of phenomena.

.1550

Dr. McLaren: I cannot predict the future any more than anybody else can. There must be a general realization of what we are facing. When we talk about quantifiable phenomena, this is true. The numbers in the claims I have made are accurate. There was a paper just a week or two ago on soil erosion by Bill Fyfe that showed how far advanced it is. In certain areas of Iowa, it has advanced 50%. This is a very serious thing. And there are many things that are quantifiable.

It may be that the kinds of things we are talking about doing now are the right ones. When we move into the future, it will be by a gradual series of steps. You do not do everything at once. There are two top-priority matters. One is to save energy, because that is the cheapest, easiest, quickest way of reducing carbon dioxide in the atmosphere and saving a

hell of a lot of money in the use of fossil fuels. This would be paralleled by heavy research on alternative energy. There is a good deal of optimism that this could be achieved after a time. A good deal of it will be paid for by what we achieve in energy saving. The energy savings that are possible are huge.

The second thing is the population explosion, which is a deeply distressing and apparently terrible problem. But we have an experiment in Indonesia that suggests that if proper family planning information is made available to women, with a certain amount of a propaganda, you get a very rapid reduction in birth rates. This has happened in Indonesia. In the next 10 years, we could prevent the runaway explosion that may occur if we do not tackle the problem now.

Many of these problems are immediate, and we should tackle the immediate problems. Acid rain in Europe is an immediate problem; the trees are dying. Acid rain in some parts of North America is a problem, too. You could name many others. You go step by step and your population encourages the politicians to recognize that this is indeed a problem. They will go along with it.

I took part in the Earth Day celebrations yesterday, and one of the things that impressed me most on Parliament Hill was the feeling of power of those 5,000 or so people. They were powerful people and they were exercising their power. This is political power the way it should be exercised. Perhaps they were exaggerating, but they were prepared to make sacrifices in the future, and I think a lot of people are.

.1555

Mr. Fulton (Skeena): How critical do you think it is that Canada reach the goal that was set by the Toronto conference of a 20% reduction in our carbon dioxide emissions by 2005? And attached to that, how critical do you think it is that we go to more rapid levels of afforestation that we heard about from Jim MacNeil this morning?

I think a lot of Canadians fail to realize that there is an acre per second of tropical rain forest being burned or harvested. Here in Canada every four seconds there is an acre either burned or harvested. We are one of the last great carbon sinks on earth, and we cannot hold that claim too much longer.

In relation to those two, has the Royal Society done much in the way of economic modelling of what Canada would look like with a steady state balanced economy—some people call it "no growth", some people call it other things—where we in fact bring our greenhouse gas emissions and energy utilizations back into balance.

Dr. McLaren: The society has not done much on economic modelling, but it could well do so. I would like to ask Dave to answer that, if he were here. Anyway, the economic story is a very difficult one where you are required to have an entirely different economic outlook, costing things as they are real.

In terms of foresty, I agree with everything you say. It is just like energy; we have to try to improve the balance of forests very rapidly. The other thing I would say in regard to forests

is that we are cutting them down quite fast. There is replanting, and it can be done in some areas. But with the clear felling or the clearing it is much harder for a forest to become re-established than with partial deforestation.

The other thing is that national parks as wilderness preserves are somewhat of an illusion. The "lovejoy", as shown in the Smithsonian, demonstrates that even quite a large area is not necessarily a suitable, an adequate reservoir to keep animals and plants alive. They are finding that now in the eastern U.S. where your forests are regenerating in the eastern U.S. There has been a considerable increase in forestry in the last 50 years. The same in the northwest. But the animals are not following it. The song birds are still disappearing and going down quite rapidly, because it is piecemeal, and the edge effect of quite large areas creates ecological imbalances.

We are a small nation, and by small I mean even things the size of Banff and Jasper parks are not an answer to preserving the ecology.

Mr. Fulton: On the Toronto conference, 20% reduction by 2005—is that a reasonable target, yes or no?

Dr. McLaren: I think not saving energy is insanity. It is insanity from every point of view. It is insanity from economics; it is insanity from the prognostication of what is going to occur. It is so obvious, and it is so easy to do.

Mr. Stevenson (Durham): You mentioned groundwater and the conservation of it. We frequently hear about the quality of our lakes and rivers, but I suggest probably not quite so frequently about groundwater, although it certainly is an issue that comes up.

Are you aware of any country that has really done a comprehensive job of stating groundwater quality characteristics, the conservation of it, the preservation of it, the extent to which it should be used, and has really put forward, as I say, a comprehensive ground water policy?

Dr. McLaren: I am not aware of any but I am sure they may exist. They may be small countries, but I am not aware of any. Groundwater is a very deceptive thing because at a certain level if you pump a reservoir below a certain point it will not recover. You get a kind of repletion which will not refill, again in living time scales. There is a good deal of water being quarried in the southwestern U.S., for instance. And when you take it, it is like taking ore out of a quarry. When the ore is gone, there is nothing else in the quarry. This is quite a common characteristic of the use of groundwater.

The Joint Chairman (Mr. Langlois): Thank you.

I would now ask Mr. Denis Pronovost, Vice-Chairman of the Transport Committee, to introduce the next witness.

.1600

Mr. Pronovost.

Mr. Denis Pronovost (Saint-Maurice): The Standing Committee on Transport is pleased to participate in this forum. Our next witness is Mr. Michael McNeil, President of the Canadian Automobile Association. Mr. McNeil studied at the universities of MacMaster and Carleton and holds a BA and an MBA in urban planning and public administration specializing in economics, finance and management.

Mr. McNeil is also a spokesman for the automobile industry on issues relating to environmental pollution and measures that might be taken to offset the automobile's effect on air quality.

Mr. McNeil has 15 minutes for his presentation.

Mr. Michael McNeil (President of the Canadian Automobile Association): Thank you very much.

I have the distinct pleasure of being here representing Canadian automobilists, and I am grateful for the opportunity to present the views, particularly, of our members on the very important issue of global climate change.

I have been challenged to present to you in 15 minutes what it has taken humankind almost a century to realize, and that is that our modern means of personal conveyance are most likely leading us down the road to self-destruction.

You may find that statement surprising coming from the spokesman of Canada's largest travel-based association. However, I will submit to you that motorists are aware of the threat posed by the transportation sector to our global environment and they have been doing something about it for many years.

Over the past 10 to 15 years motorists have contributed greatly to environmental protection. They have dramatically reduced air pollution by welcoming and paying for catalytic converters, positive crankcase ventilation, closed-loop emission controls, electronic ignition, and exhaust gas recirculation—and that is only to name a few. Motorists have also accepted and paid for numerous improvements in automotive technology that improved fuel economy and reduced emissions of carbon dioxide, a major greenhouse gas. Among these are vehicle down-sizing, fuel injection systems, radial tires, aerodynamic designs, and many more. Many other sectors are only awakening to their responsibility.

As Canada's largest consumer-based organization, CAA speaks to you today on behalf of our 3.2 million members across Canada, who are motorists first indeed, but they are also very concerned Canadians. CAA is dedicated to serving the interest of the motoring public and has been for over 75 years. Our comprehensive public policy process is fundamentally based on the views of our members. In turn, we seek to promote a sense of responsibility and awareness among our members through a number of vehicles, including public education programs.

We also develop and promote comprehensive public policy recommendations, which represent both our members' best interests and the best interests of all Canadians. This is

particularly true where environmental protection is concerned. At CAA this commitment has been ensconced in our own operations policy. We have set forth our commitment to environmental protection in the statement now on the screen. A complete copy is now available or has been made available to you as a hand-out.

If we are to achieve our goal of maintaining an acceptable environment then we will face many challenges, but perhaps one of the greatest of these is the challenge to correct misperceptions that may lead to wrong decisions. Global climate change is a complex issue and there is much misinformation. Let me cite one example, a recent newspaper article:

> Refined oil products, mainly from transportation, account for 44% of carbon dioxide emissions in Canada. That makes them the largest source of emissions.

On the other hand, the photo caption stated:

> Cars produce 44% of the carbon dioxide emissions in Canada.

Obviously both cannot be true, and in fact neither represents a true picture of reality. Unfortunately, such misinformation increases confusion among the general public. The potential for governments to make bad decisions on environmental policy increases as this type of misinformation is presented, particularly when governments rely heavily on public opinion.

.1605

Another case in point is simply on the side wall of this room today. There is a pie chart. It identifies that 25% of carbon emissions are a result of transportation. That is wrong. It identifies that 18% of carbon dioxide emissions are from electrical conservation. That is wrong. These are on your walls in the House of Commons here today.

In fact, passenger cars only produce 10% of Canada's carbon dioxide emissions. As you will note on the chart now displayed, power generation is at 20%, industrial fuel combustion is at 14%, other road vehicles, such as trucks and buses, represent 13%, and heating is about 13%. All of these make up a larger proportion of the pie than the automobile does. Nevertheless, the CAA, our members, and Canada's motorists believe something can and will be done, and they are ready and eager to help protect Canada's environment. They are prepared to do their share, as they have in the past, as they are doing right now, and as they will continue to do in the future.

Let us continue to clear the air for a moment. This slide illustrates improvements in fuel economy over the past 10 years alone. The amount of CO_2 produced is directly proportional to the fossil fuel combusted. CO_2 emissions from both new cars and the entire vehicle fleet show significant decreases over the past decade, and they will continue to show decreases as the fleet is replaced.

This graph shows how automobile emissions of nitrogen oxide have also decreased and will continue to decrease through the year 2005. Auto emissions will decline even further with the adoption of California emission standards. As you know, the government has

announced its intention to implement these standards in Canada beginning in 1994. CAA applauds the initiative.

You will also notice that the NO_x emissions from other sources are increasing sharply. The story is exactly the same with VOC emissions. Car emissions continue to decrease as more and more vehicles meet the 1987 emission standards. Emissions will decrease even more with California standards once again, and at the same time emissions from other sources continue to rise. Again, carbon monoxide emissions from cars continue to go down. Other sources continue to increase. Total emissions of all of these substances from cars have gone down even as the total vehicle registrations have gone up.

This graph represents per vehicle emission reductions. The green bars at the back depict pre-regulated levels of emissions. The blue bars portray current levels, and the yellow bars depict what will be achieved in the very near future. On a per vehicle basis, tremendous reductions have been achieved since the early 1970s. Emissions of nitrogen oxide, VOCs, carbon monoxide and other pollutants have all gone down because of the motorist's willingness to pay for cars which pollute less. A motorist is now paying over $500 on average for emission control equipment alone on each new car purchased. With California standards, they will pay an additional $200 per car to protect the environment, and willingly so.

The graph also depicts how emissions of CO_2 have decreased since 1970. Further improvements in fuel economy will further reduce this figure by an as yet undetermined amount. The graph also portrays lead emissions. Motorists have accepted a total phase-out of leaded gasoline by the end of this year. Automotive lead emissions will be reduced to zero.

Although it is not a tailpipe emission, CFC-12, which is used in automotive air conditioners and is linked to ozone layer destruction, will also be eliminated by 1994 in new automobiles. We have introduced automotive emissions of several pollutants which are not directly responsible for global climate change in order to provide you with a little bit more of an accurate picture of the automobile's interaction with the environment.

Another example where the motorist has been falsely accused of being a significant contributor to environmental damage is in the case of acid rain. In fact, the automobile emits only 0.4% of the sulphur dioxide in Canada, hardly a trace in comparison with others. Sulphur dioxide is the primary agent in acid rain. When combined with the nitrogen oxide output of automobiles, only about 2% or a little less than 2% of total acid rain production can be accounted for within the entire automobile fleet. I think it is also important to clarify that the automobile emits none of the following greenhouse gases, nitrous oxide, CFC-11 or even methane.

.1610

Over the past decade or so the motorist has accepted and paid for a number of environmentally friendly improvements to the automobile. A very brief list includes

catalytic converters, as I have mentioned, and a number of fuel improvement measures such as fuel injection systems, advanced transmissions, aerodynamic designs and radio tires. For a number of years CAA has played a very active role in public policy debates on the motorist's behalf. We have indicated our support to government for legislation to reduce and subsequently phase out lead in gasoline, to promote re-refining of used motor oil, including the establishment of the necessary infrastructure to make this a viable measure, and to eliminate the use of CFC-12 in new automobile air-conditioners by 1994. One positive measure yet to be adopted by government we have advanced is the simple removal of the $100 excise tax on automotive air-conditioners that do not use CFCs.

At CAA we realize that motorists' past achievements are not enough. We must continue our protection of the environment and continue the necessary improvements to ensure sustainable development. Canadians' attitudes are important. Inasmuch as they are based on fact and not misinformation, they are a good indicator of what Canadians are willing to do in the future to protect the environment.

A national poll conducted by Southam News late last year asked many Canadians what they would do to protect the environment. By far the top three activities were recycling of waste, avoiding styrefoam packaging and seeking biodegradable products. Given the necessity of the automobile to most Canadians, it is not surprising that at 51% there was less support for changing driving habits. However, some alternatives such as car pooling were deemed to be a potential benefit. Others considered walking or taking public transit to be alternatives to driving in some instances when it was practical.

At CAA we believe a number of environmentally favourable transportation-related policies can be implemented and are not harmful to the social or economic well-being of Canadians or of Canada. A recent CAA survey of our members indicated support for alternate fuel use. There were 80% who indicated their support for the development of alternate fuel vehicles that pollute less. Over three-quarters said they would pay slightly more for an alternate fuel that polluted less. CAA supports the development of alternate fuels. A number of alternate fuels that have been proposed—propane, ethanol, methanol, electricity and hydrogen, to name only a few—may all be part of the short- or the longer-term solution. It is imperative that research and development dollars continue to be channelled in this direction as we search for viable alternatives to the burning of fossil fuel.

One very important question is whether people would be willing to give up their personal automobile. Would Canadians be willing to do without their cars? Would you be willing to do without your car? I believe the answer is a definitive "no". Not only is the automobile a necessity in a country as large and sparsely populated as ours, but the economic and social costs associated with limiting or restricting automobile use are catastrophic. Our society is built around the automobile. The automobile is a necessity for Canadians and by far their primary means of transport to their place of employment, businesses...tourism, all of these. Transportation-dependent sectors are all so very much dependent on our freedom of movement and our accessibility to our personal conveyance.

We accept that the automobile is here to stay, but we also recognize and accept that far more can be done to ensure protection of the environment. By all means, we should be establishing objectives that continue the excellent results we have achieved to date, but we must make them reasonable, realistic and reachable, the three Rs of cleaning up our act.

The approach to transportation planning must be comprehensive and one that offers consumers viable options. It must take into account intra- and inter-urban transportation needs and ensure the efficient transportation of goods and people. A national highways policy is an excellent beginning as our fully integrated facilities, including rail, air, and mass road transit.

.1615

Within the urban context, a number of specific actions can be taken in relatively short order. In particular, high-occupancy vehicle lanes, car pooling, better and faster public transit, more park and ride facilities, and even bicycle paths will all lead to a cleaner environment.

One area that deserves special attention is traffic congestion. Measures that could be implemented almost without delay include better synchronization of traffic lights and increasing road capacity for better vehicle flow in overcrowded areas.

A problem area is always rush hour. Now, that is a misnomer: it would more aptly be termed dead-slow hour. In any case, rush-hour truck restrictions can be imposed to improve traffic flow.

Finally, staggered work hours would spread the increased traffic over a longer timeframe and reduce congestion.

In implementing these kinds of measures, automobile emissions can be reduced by upwards of 11%, we have been told. Similarly, positive benefits will be achieved by other policies supported by CAA and our members. These include measures such as improved fuel economy objectives, tighter emission standards, mandatory emission testing to insure the integrity of the automobile's original pollution-control equipment, tax-free emission-control equipment, and point-of-purchase vapour recovery systems. These are positive and progressive measures.

It is equally important to state at this time CAA's absolute opposition to punitive measures such as carbon or fossil fuel consumption taxes. The two McNeils before you in this committee today part company on that fact.

At CAA we believe carbon taxes would only exacerbate the already unfair taxation of the motorist. This graph compares gasoline prices, as an example, in Canada and the United States. On both graphs the yellow and green blocks above the thin white line represent government taxation. Canadian prices are more than 50% higher than those in the U.S. More than 80% of the difference is made up of federal and provincial taxes.

To add carbon taxes to our existing gasoline taxation structure would only compound the difficulties faced by businesses in competing with their American counterparts. Carbon taxes would prove highly inflationary, and in all likelihood they would be completely ineffective in protecting the environment. The considerable increases we have seen in federal and provincial gasoline taxes over recent years have had very little impact on consumption, primarily as a result of the essential nature of the automobile.

In addition to being ineffective and inflationary, carbon taxes are clearly not publicly supported. A recent survey indicates a tax-worried public is no longer willing to accept them. Make no mistake: carbon taxes are not the means to a solution to the problem of global climate change.

We have come here today as representatives of our 3.2 million members. Collectively, they have a vision for Canada's future. It is one where we will continue to enjoy the freedom of movement and access to their personal choice of mobility. In responding to the challenges of sustainable development and environmental protection, they will enjoy the fruits of their efforts by communing with Canada's natural beauty.

In the Canada of the future, our members see a mutual respect between the automobile and the environment. Heightened concerns for the environment will be backed up by actions—actions that will be built on the motorists' already impressive record of achievement and protection of the natural habitat. In turn, the automobile will maintain its rightful place as our major transporter of goods and people.

It is absolutely essential that controls, regulations, and guidelines be established to protect the environment. We are prepared to support measures that are reasonable, realistic, and reachable and that recognize that the automobile is a necessity for many Canadians, indeed the majority.

In the past 20 years motorists have been leaders in environmental protection. I believe they are prepared to continue leading the battle against global climate change, but only as a partner within a comprehensive action plan.

Thank you very much for this opportunity. It has been a delight.

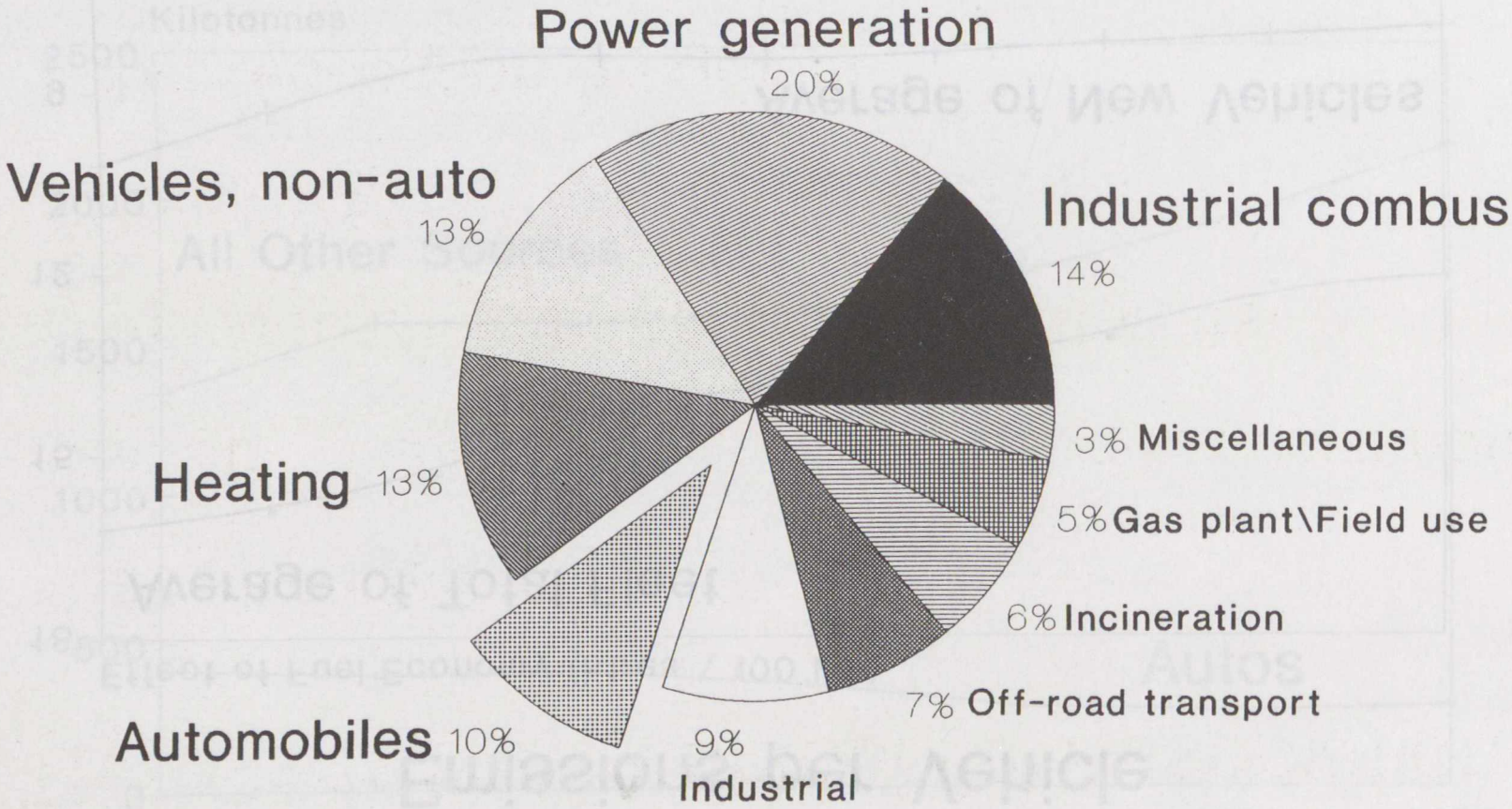
CAA Commitment to the Environment

"The Association starts by recognizing the basic incompatibility between...motoring, and complete preservation of our environment.... It is essential controls, regulations and guidelines therefore be established for the future if we are to maintain acceptable environment. The vast majority of m are caring, responsible citizens, who...wish to be continue to enjoy their motoring in a way that i harmful to the environment."

The Canadian Automobile Association

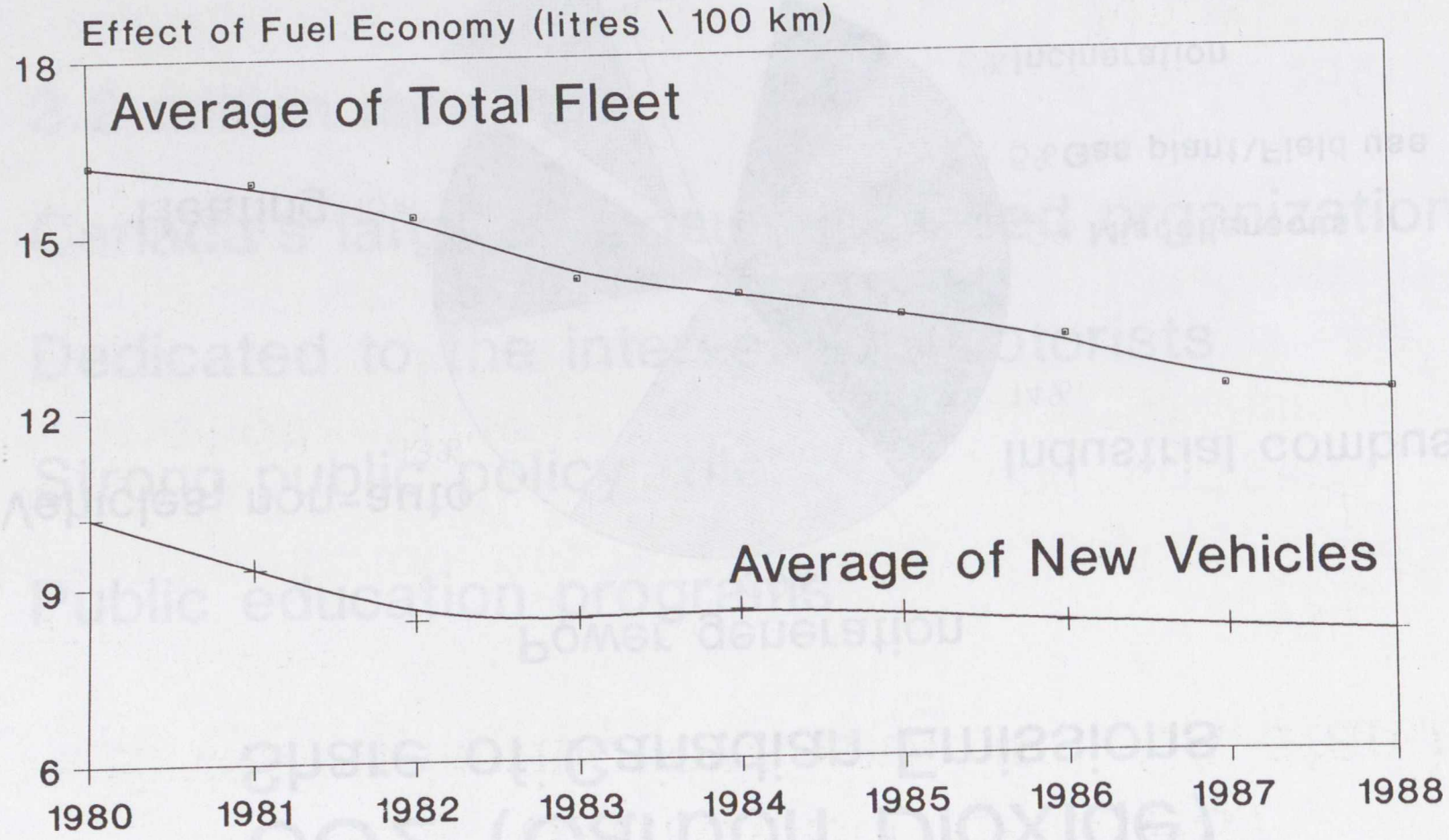
- 3.2 million members
- Canada's largest consumer-based organization
- Dedicated to the interests of motorists
- Strong public policy role
- Public education programs

CO2 (Carbon Dioxide)
Share of Canadian Emissions



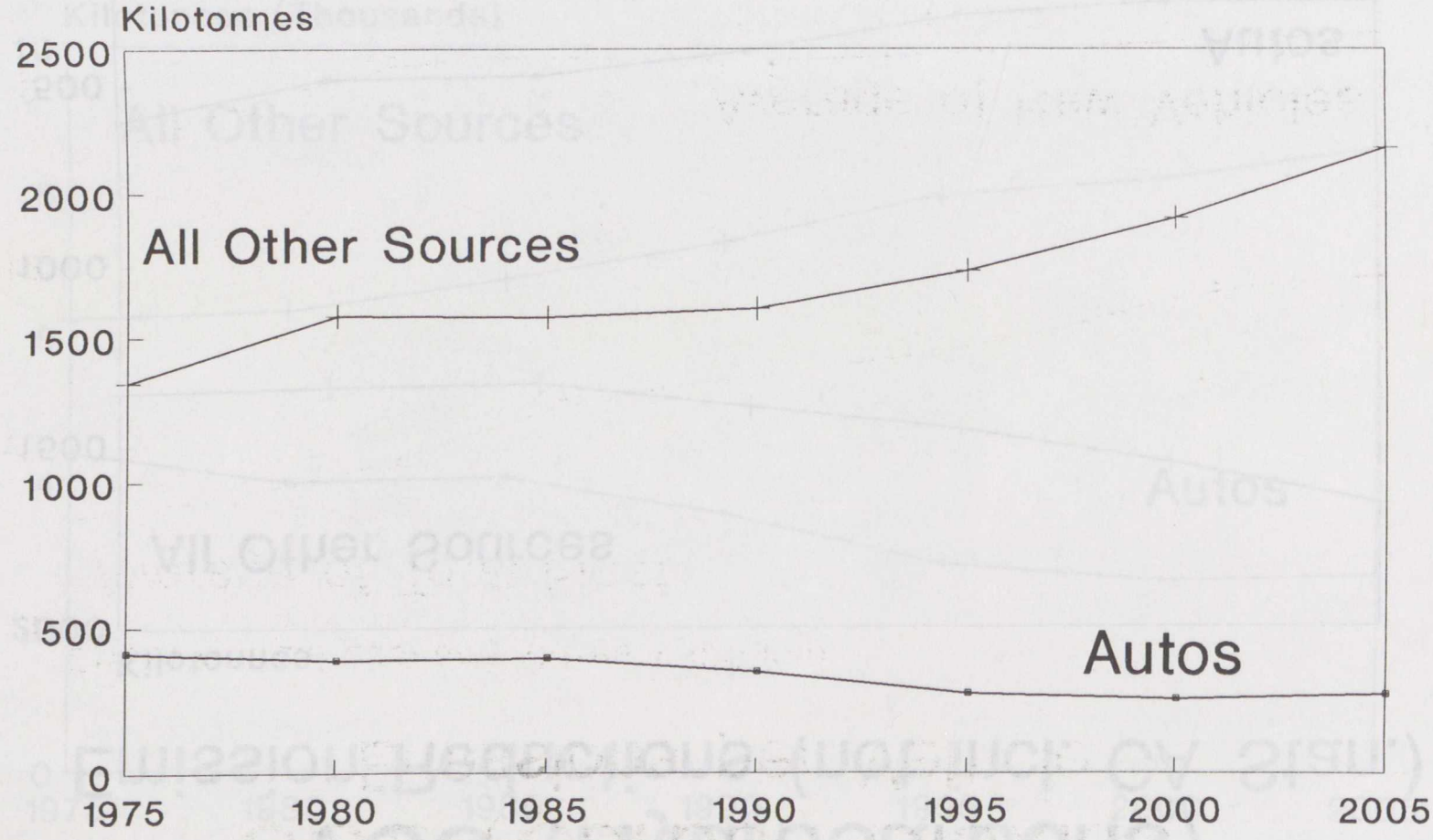
Source: Environment Canada

CO2 (Carbon Dioxide)
Emissions per Vehicle



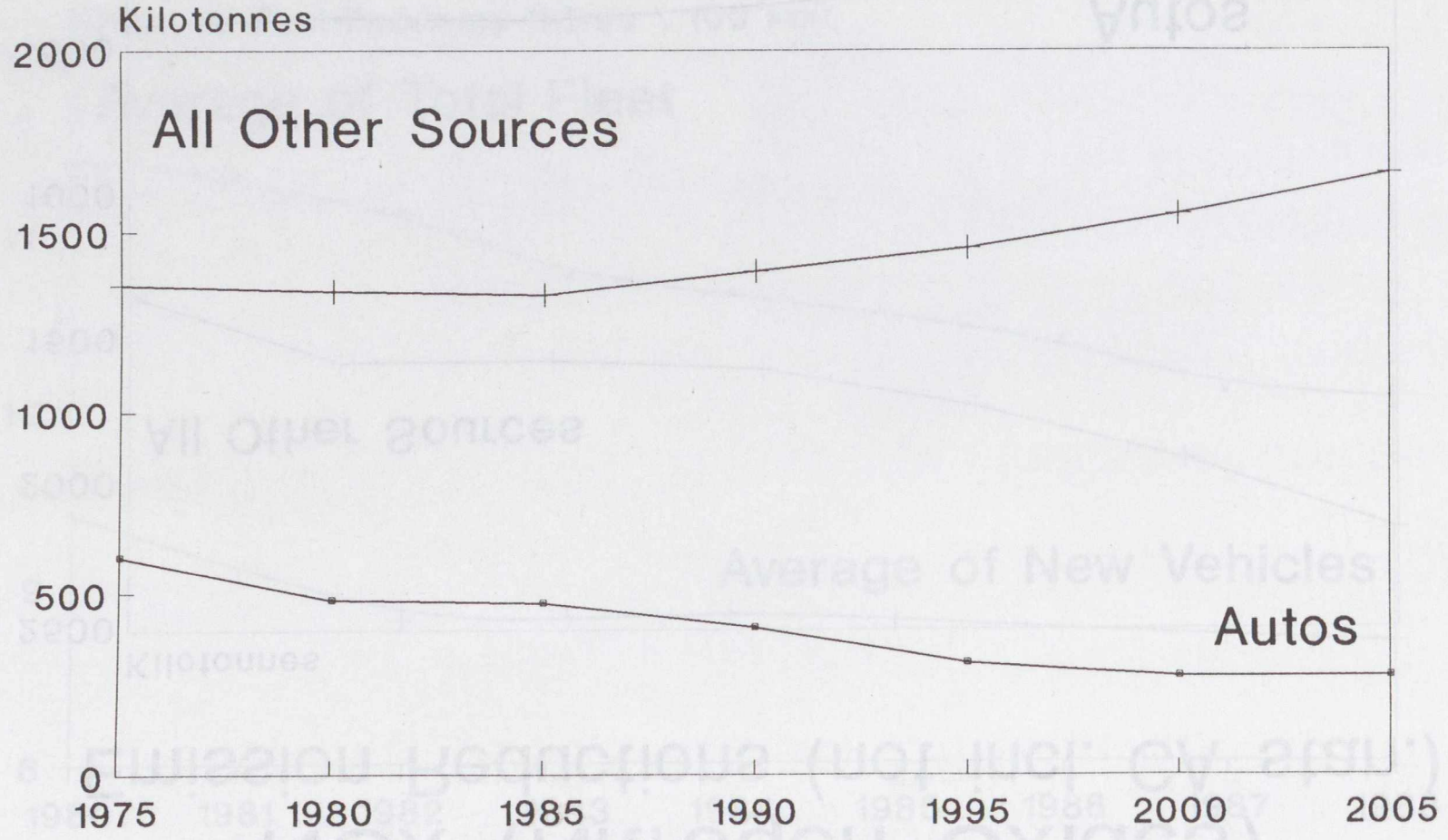
Source: Transport Canada and Stats Can

NOx (Nitrogen Oxides)
Emission Reductions (not incl. CA stan.)



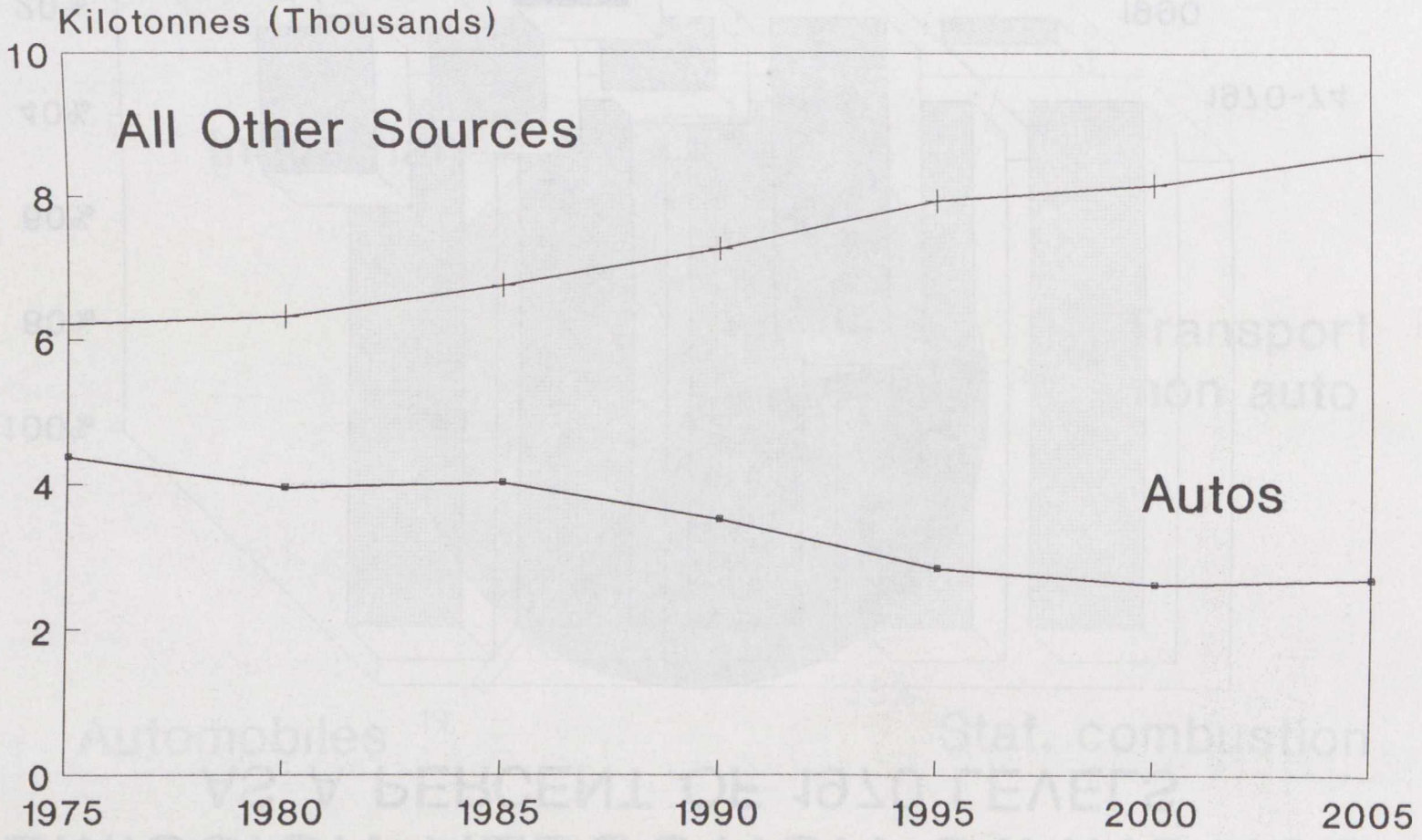
Source: Envir. Canada & Transport Cda.

VOC (Hydrocarbons)
Emission Reductions (not incl. CA Stan.)



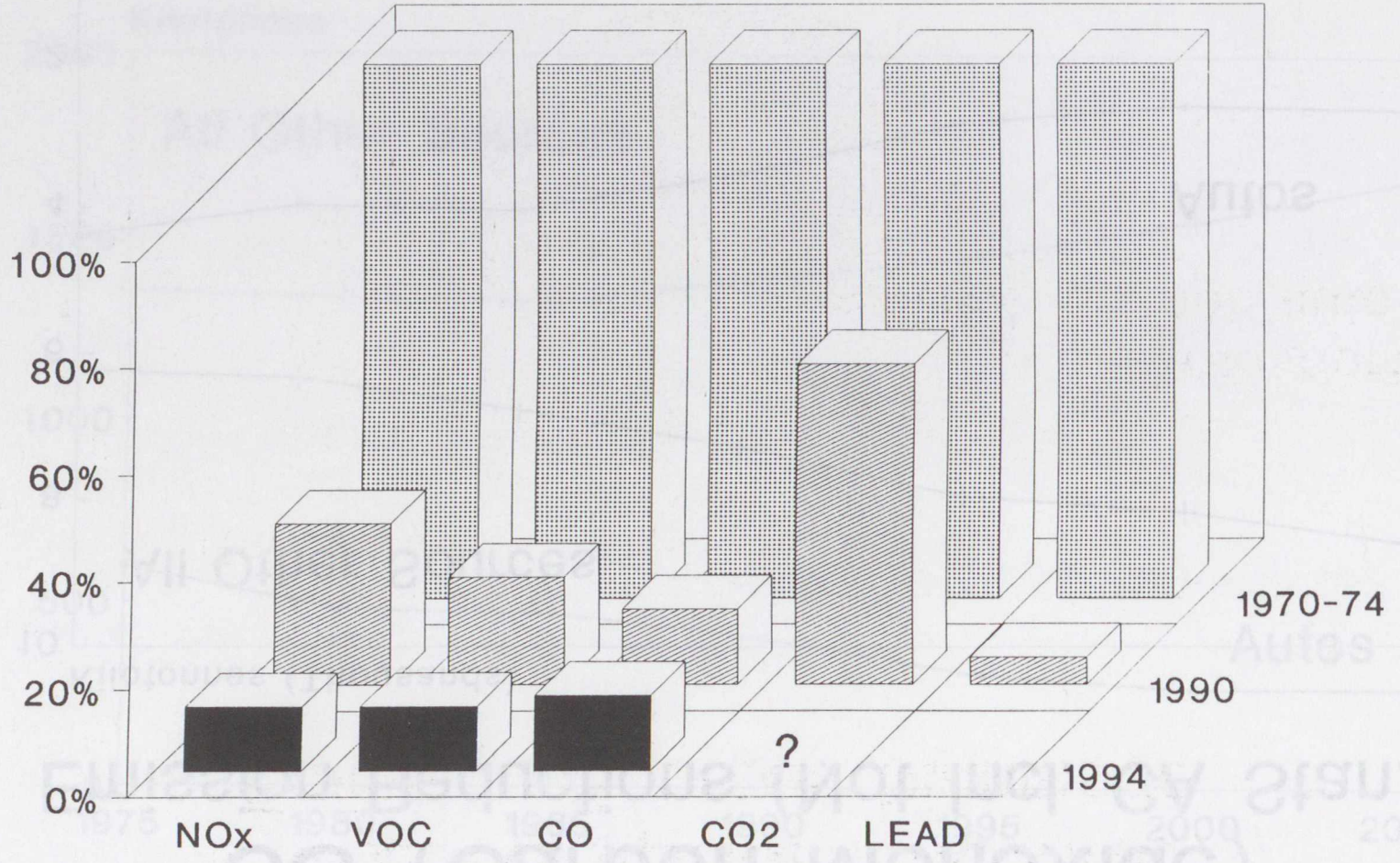
Source: Envir. Can. & Transport Can.

CO (Carbon Monoxide)
Emission Reductions (Not Incl. CA Stan.)



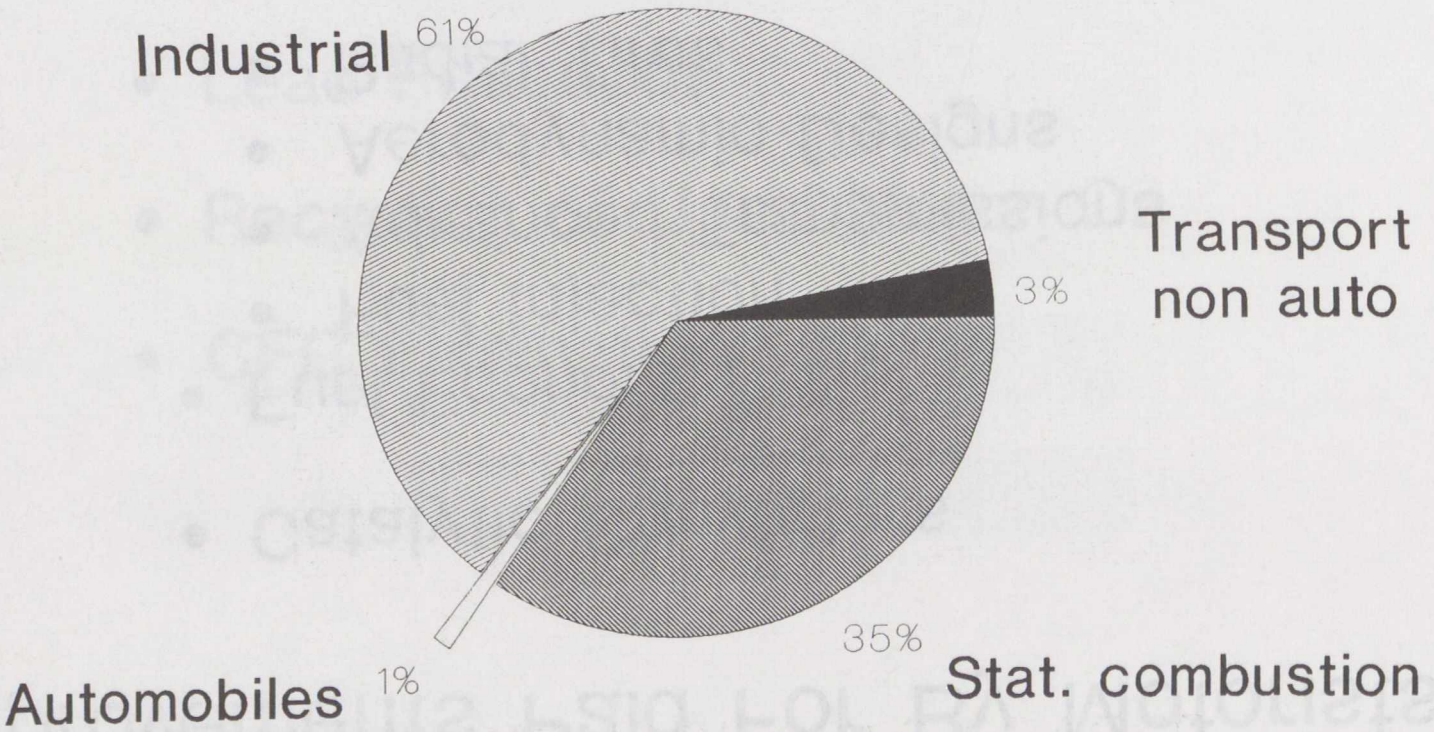
Source: Envir. Can & Transport Can.

EMISSION REDUCTION STATISTICS
AS A PERCENT OF 1970 LEVELS



Source: Federal Emission Standards

SO2 (Sulphur Dioxide)
Emission Sources Manmade



Source: Environment Canada

Improvements Paid For By Motorists

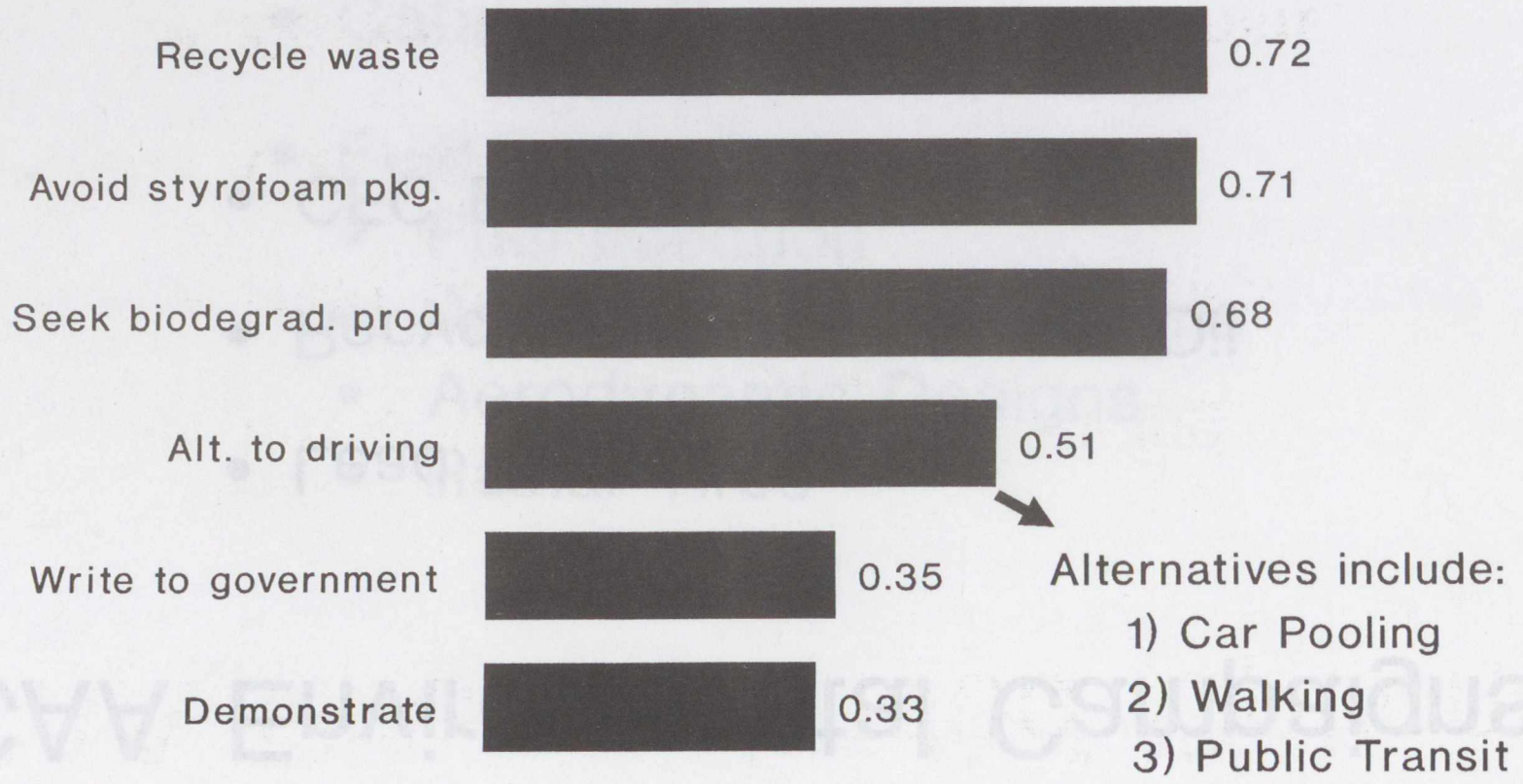
- Catalytic Converters
- Fuel Economy:
  - Fuel Injection
  - Advanced Transmissions
  - Aerodynamic Designs
  - Radial Tires

CAA Environmental Campaigns

- Lead Phaseout
- Recycling of Used Motor Oil
- CFC Elimination

Attitudes of Canadians

What Canadians Are Willing To Do



Source: Southam News

CAA Recommended Options

- Integrated Transport Planning
- High Occupancy Vehicle Lanes
- Car Pooling
- Better and Faster Public Transit
- Park and Ride
- Bicycle Paths

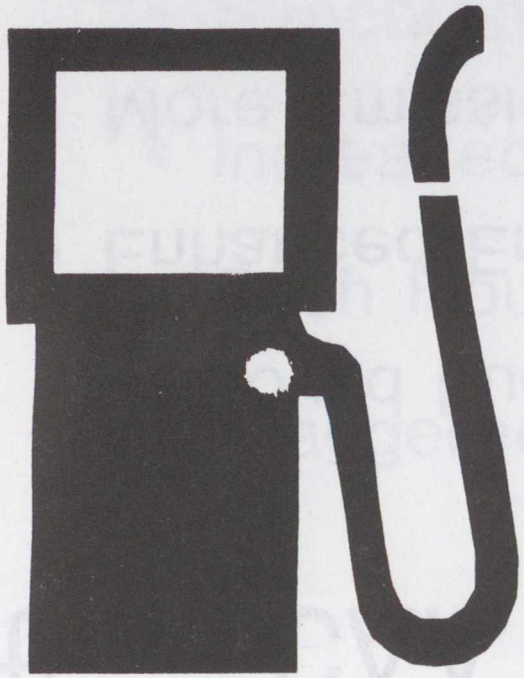
CAA Recommendations
To Reduce Congestion

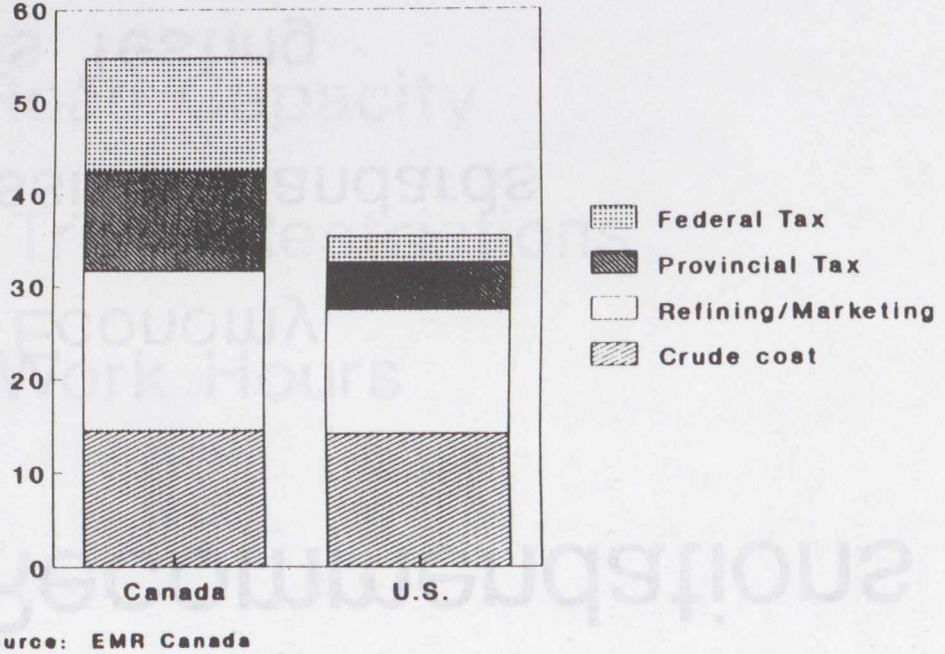
- Synchronized Traffic Lights
- Increased Road Capacity
- Rush Hour Truck Restrictions
- Staggered Work Hours

Other CAA Recommendations

- Improved Fuel Economy
- Enhanced Emission Standards
- More Emissions Testing
- Point-of-Purchase Vapour Recovery

COMPOSITION OF RETAIL GASOLINE PRICES





Source: EMR Canada

The Co-Chairman: Thank you very much, Mr. McNeil. Reasonable, realistic and reachable—your three Rs. That is great.

Mr. Johnson (Calgary North): Mr. McNeil, I was really very interested to hear your presentation because in a sense, if you do not mind my saying this, it is a classical special-interest presentation.

.1620

I have some sympathy and empathy for your position because I drive a car, as most people do, but I am rather concerned that your presentation comes across as a, yes, let us all cut, but please not me: over there, if you do not mind.

I would say that I am also a non-supporter of the carbon tax, but I think that a lot of the progress that is made in the automotive industry is coming about through legislation, not through spontaneous action. I think we have to recognize that there is a role for legislators to play in this overall objective-setting.

I wonder if you could tell me if you, as I, are against the carbon tax. Are you also against taxes that...? For example, let us say we have a situation where we have licensing of vehicles and we test them before we license them and each year you drive your car in and it gets a certain pollution rating and you are taxed according to that rating. Would you also be opposed to that type of legislative control or direction-giving to the motoring public?

Mr. McNeil: Basically, I do not mind at all your observation that it was a classical special-interest presentation because there is perhaps no larger segment in the Canadian population as a special interest group than the motorists. And if it was classical, then I feel very proud that we have been able to give that to you.

In terms of legislation, not spontaneous action, that is very true. I would submit to you that the legislation that has been imposed on the automotive industry or within the vehicle sector or the automobile sector in Canada, has been very tight, has been very easy, and has been very compliant with those legislations.

Certainly we do not have the same problems today in the automotive industry in conforming to the regulations that have been imposed as does some of the heavy industry which is out there having a very difficult time either meeting the standards or trying to beat the standards.

Finally, I think what you have asked is: is the CAA opposed to the idea of taxing an individual because of the amount of carbon or whatever that he or she is polluting? We are absolutely opposed to any further burden that is going to be taken out on the motorist for doing whatever he or she is doing. What we would prefer—and we have stated that very straightforwardly in this presentation—is that there be a control, an emissions-testing program that would maintain the vehicles' environmentally friendly character. As time goes on and regulations and legislation gets tougher and tighter, then obviously those standards would be increased, as would the testing, as would the conformity to them.

Mr. Angus (Thunder Bay—Atikokan): Mr. McNeil, I appreciate the very frank presentation you have made today. You suggest that carbon tax will not work. In effect, what we have had in Canada for a number of years, although we called it differently, is a carbon tax. Your slide showed the differential between us and the United States, primarily due to provincial and federal taxation.

I say to you that it has worked, because we have diverted our automobiles onto American highways. Canadians travelling from one point in Canada to the other, go through the United States because of the price. I have been told that the American government is ready to impose its own carbon tax. Perhaps you have some information that may assist us in determining whether or not their proposal will put in place a level playing field—dare I say it—so that we will no longer have that diversion and will be able to act in unison to attack the damage to the environment.

Mr. McNeil: Madam Chairman, with your permission, I will whisper something and that is.... In other words, can you read my lips? The AAA, our sister club in the United States has been guaranteed that there will be no new taxes, particularly the carbon tax, and that they will find other ways of affording or paying for some of the things they wish to do. However, having said that, even if they were to go back on their words, which I guess some governments have been known to do—not in this country, of course not—

.1625

Mr. Angus: At least not today, yet.

Mr. McNeil: But if that were to take effect and there was a carbon tax in the United States, that still would not likely take it up beyond the levels where Canada is. Currently, with the excessive taxes we have, with excise tax, federal sales tax, or the new GST, provincial road taxes, or provincial other taxes, whatever they throw on there, it would not bring it up. We would still find a number of people going down to the United States.

I would submit to you that the people are not going to change their driving habits in terms of getting behind the wheel and going some place. They may change their route to take advantage of lower gasoline costs in the States, but they still want to and still have to get from point A to point B, and I really do not believe people are going to give up their driving habits because of the price of gasoline, as has been witnessed by the charts I showed on the screen, where consumption has remained relatively flat and price has escalated tremendously.

Mr. Angus: So your answer really is the kind of cars we build and put on the road.

Mr. Pronovost: Mr. NcNeil, let us accept the hypothesis that we are going to meet all of our emission standards during the next year to come. But everyone knows that in Asia, especially in China, there is a potential new growth of car ownership. Do you not think that the gains we make here would be wiped out because of increased car ownership in those countries?

Mr. McNeil: The CAA is a world-wide organization, and we are certainly concerned with what is going on in other parts of the world.

I believe we have found the answer in Canada in terms of being able to respond to a growing fleet with tighter emission standards and with tighter controls or standards on fuel economy, and I believe they have been able to do that North America-wide, because as our fleet has increased—fleet being all passenger vehicles in Canada or in the U.S.—emissions have continued to decline and are still projected to decline.

World-wide I have a much greater concern. There is a movement afoot now through our affiliate clubs—the AIT, which is the Alliance internationale de tourisme, a world body of auto clubs, and the Fédération internationale de l'automobile, FIA—around the world. I believe that through those mechanisms and through working together the message can spread. But I certainly think we have responded well in North America. We will continue to respond, and we look forward to responding. Globally, let us hope that other countries follow suit.

The Co-Chairman: The Chair, before recognizing Mr. Caccia a bit earlier provided a second chance to the government side, so we will recognize Mr. Caccia at this time.

Mr. Caccia: I applaud your decision to recognize at least one question for each party, which is a well-defined tradition in this place.

Mr. Chairman, it is quite clear that Mr. McNeil does his best to represent an association, and it is regrettable that we were not able, for time reasons, to also include a representative from an association that speaks on behalf of public transport. We would have heard some interesting and alternative views, as you may well appreciate.

We would have heard, probably, that we live in a fool's paradise at 60¢ a litre for gasoline, compared to what is being charged in countries that are more competitive with us in international markets, such as Europe and Japan. We would have heard also that it is much cheaper in urban Canada. In many urban centres it is cheaper to travel to and from work by car than by public transit, and this is because of the weakness of municipal policies that do not adequately charge for meters and parking, and also because of the very low cost of gasoline.

So we must take, therefore, the presentation by Mr. McNeil as a sectoral representation, with its limitations of course, and invite the Canadian Automobile Association to become more progressive in its outlook as to what it should do through its membership in promoting the cause of of reduction of CO_2 emission. I have no questions for Mr. MacNeill. Thank you.

.1630

Mr. McNeill: You had actually asked a question when you were speaking. You asked what would we have heard from the public transit authorities or the public transit people. I submit to you that we would have heard basically what I had suggested to you in the brief,

and that is that we favor additional public transit facilities. We favor and think a tremendous amount of improvement is necessary within those transit facilities. We certainly would like to see those improvements take place.

We are advocating that they fund themselves by finding money, increasing their fares, becoming self-sufficient. There are all sorts of things that we as a very responsible organization, representating much more than just the automobile.... After all, we are the largest travel consumers in Canada, not only automobile.

I think you have a very fair presentation of virtually all the sectors of transportation, save perhaps the large trucks.

Mr. Caccia: Would that require a carbon tax?

Mr. McNeill: Why put that on the backs of motorists when in fact it is not motorists who would be using it? After all, what this government has tried to do and what many governments are trying to do nowadays is to have a user-pay situation. I think if you were to look to the users of a system...and you would increase the use of a system if it were much better presented and made a lot more convenient and available to people.

Mr. Caccia: It is because we would want to put the right burden on a non-renewable resource.

The Joint Chairman: Our next witness is Dr. Hélène Connor-Lajambe, President and Managing Director of the Centre for Energy Policy Analysis. She is the witness invited by the Standing Committee on Energy, Mines and Resources.

Dr. Connor-Lajambe is a member of the National Round Table on the Environment and teaches a course on environmental economics and policy as part of the University of Quebec's Masters Program in Environmental Science.

Dr. Connor-Lajambe received her doctorate in economics at McGill University in Montreal. She has worked in a number of research centres formulating ecologically acceptable strategies that will be viable over the long term. I would like to point out to her that we appreciate her coming here today.

Mme Connor-Lajambe est titulaire d'un doctorat en économie de l'Université de McGill à Montréal. Elle a participé dans plusieurs centres de recherche à l'élaboration de stratégies énergétiques efficaces acceptables sur le plan écologique et viables à long terme. Madame, je vous remercie d'être venue.

Ladies and gentlemen, Dr. Hélène Connor-Lajambe.

Mrs. Hélène Connor-Lajambe (President, Centre for Energy Policy Analysis and Member of the National Round Table on the Environment and the Economy): Madam Chairman, ladies and gentlemen, our production and use of energy are major factors contributing to the pollution and climate change we are witnessing throughout the world, and which we have only very recently detected. That is why any corrective measures and

policies aimed at reversing the situation will necessarily call into question our energy policies and influence all of our activities, both on an individual and a collective basis, since a global threat requires a global response.

The greenhouse effect will either come to nothing or it will end in a new equilibrium with new forms of life. But in the meantime the earth will probably be subjected to temperature extremes, both very hot and very cold, as well as flooding, hurricanes and famines. Even if global warming should prove to be illusory or reversible—which is impossible to prove—mankind still has to face global water, air and land pollution. Most of this pollution is due to our production and use of energy. We should therefore start with the energy sector, which would allow us to kill two birds with one stone: on the one hand by decreasing the greenhouse effect, and on the other hand by decreasing pollution. We would even have killed a third bird, since we would thereby decrease our energy expenditures and conserve our resources.

The Canadian energy sector, in its present state, is not open to free market forces. There is no real competition and no real level playing field. Basically it is a monopoly or an oligopoly. Furthermore, energy prices do not include most of the cost of supply, which is born by the general public even though the public has not been consulted and has no voice in the matter. In order to correct the situation, the famous rules of the market place could be put in place. In the meantime, however, imaginative corrective action, not involving government intervention, must be taken to deal with the environmental challenges we are facing.

A consistent energy strategy should take a two-tiered approach. First of all, it should deal with the most urgent problems first and try to restrore a balance in the energy market by implementing realistic energy policies by means of measures that produce immediate results. At the same time, there should be an educational program, which could be started by consulting people on the Green Plan. Politicians, energy specialists, NGOs, government officials and ordinary citizens would collectively define their vision of the future and decide what resources they are prepared to devote to it.

.1635

This process would also enable energy analysis to think about and fine-tune their approach to the issue, so as to seek sustainable, long-term development in the energy field. The purpose of the immediate action would be to drastically reduce if not eliminate the emissions that produce the three major types of greenhouse gases: chlorfluorocarbons, methane and carbone dioxide. After all, when the bath-tub is overflowing, reducing the waterflow is not enough. You have to actually turn off the tap.

People long believed in nature's infinite ability to assimilate and absorb. But we were wrong. By sending our emissions out through huge smoke stacks, we merely spread the pollution farther, faster. It is possible to reduce CO_2 by 20%, and it is in fact economically profitable, as a number of studies, in particular one conducted by the Canadian

Government, have shown. However, that alone will not be enough. We should not be reducing our emissions by 20% by the year 2005, but rather by half if not three quarters.

If your child has a fever, you do not merely provide 20% of the care he or she requires. We now know that the earth is a complex, living organism that reacts and tries to adapt. Given what we have done to the earth over the last 200 to 300 years, and particularly over the last half century, it is not difficult to understand why there has been a sudden increase in fever. We do not need any more studies. Nor does Canada need to wait for other countries to make up their minds. Canada is one of the largest sources of CO_2 emissions per capita on the planet, and cannot miss such a fine opportunity to set an example and make up for its past emissions through an intensive reforestation program and an immediate attack on the most serious pollution problems. They are as follows: the use of fossil fuels to generate electricity, gasoline-and-diesel-fueled vehicles, and air conditioning systems using CFCs, which also deplete the ozone layer.

Logically, the first objective should be to take advantage of the significant potential available for increased energy efficiency in buildings, lighting, small engines and so forth. Conservation is still the most immediately available source of energy, the most ecologically acceptable and also the cheapest.

Elimination of waste will provide us with a source of energy right in our own backyard. Ontario, to mention one example, has prepared an energy supply curve that includes conservation measures and shows the clear finincial advantage they offer over any conventional source of supply. Tremendous energy savings—and therefore financial savings and an improved environment—are within our reach. In most cases, all that is needed is reliable information, proper demonstration projects and quality control procedures.

The public should be informed about these measures through the updating of consumer standards and building codes. Government should inform developers of the existence of these measures by putting an end to direct or indirect subsidies for megaprojects that have a harmful impact on the environment.

Even hydro-electric projects would be re-examined, because deforestation contributes to the greenhouse effect in two ways: through the emission of methane and by eliminating trees, which neutralize carbon dioxide. We have found through experience that building megaprojects is not consistent with regional development. Such projects often merely exacerbate under-development or improper development of some regions, as seen in projects in the Third World, James Bay and the Tennessee River Valley.

Adjustments that could require price increases or other penalties should be combined with or rather preceded by programs to encourage the use of viable alternatives and the installation of new systems so as to maintain equal access for all and a balance among the various sectors of the economy.

With the creation of a market for clean energy and environmentally friendly technology, the conditions allowing for the free play of competitive market forces will gradually be established. However, in the medium term, the government has a major role to play as an organizer and subsequently as an adjudicator once a level playing field has been achieved. As a result, we could expect that Canada would initiate or support certain measures such as the following ten:

— A re-evaluation of energy projects from the point of view of both supply and demand, on the basis of their ability to reduce greenhouse gas emissions. This project could be conducted as part of a more comprehensive study that would make a rational analysis of all our energy options.

— The restoration of prices that reflect the true cost of energy by eliminating unjustified production subsidies.

— Encouraging improved energy efficiency in all sectors by informing consumers of the total energy cost and the efficiency of various devices available.

— A compulsory reforestation program using various species of trees, which would at least be equal to those cut down or lost when land was flooded to build hydro-electric dams over the last ten years.

— A public transit renewal program so that people can do without cars, at least in downtown areas.

— The adoption, by 1992, of California's standards for motor vehicles.

— Preparation of environmental emergency plans and practice implementation so that we could deal with a situation such as exists in Lithuania at the moment, except that we would have chosen to impose an embargo on fossil fuels.

— Facilitating the immediate transfer of our best ecologically friendly technologies to Third World countries requesting them. These countries must be able to develop without repeating the mistakes made by the industrialized world.

— Speeding up ratification of the Montreal Protocol on the Elimination of CFCs.

— Support for the 20% reduction in CO_2 emissions by the year 2005, as given by Toronto in February 1990.

— And finally, proceeding with other global agreements, while at the same time urging that an international monitoring body be set up.

While we are taking these immediate corrective steps, we must think in the longer term and adopt the preventive approach. We must develop a viable, long-term energy policy that is not only technically and economically efficient, but also socially acceptable.

For several years now, analysts have started looking at the energy issue by examining both sides of the equation, not just an increase in the supply of megawatts, but also demand

management, expressed as negawatts. Thanks to this approach, analysts determine the famous potential for improving energy efficiency. The approach has also led to least-economic-cost planning, including tendering mechanisms, which allows us to have a freer energy market and has produced very encouraging results where it is already in use.

In Canada, we can start thinking about energy policy at the point where the study by the Friends of the Earth left off in 1984. This study was reviewed in 1988 as part of the Energy Options process. It has stood the test of time and statistics, and points us toward economically and ecologically sustainable development. The soft energy path, with a flexible and decentralising approach that includes least-cost planning, will allow us to devise a strategy to deal with a problem as complex as that of climate change. Applying this strategy, however, will require more respect for economic and ecological criteria.

The energy issue is much too closely linked to social behaviour to be dealt with through purely technical solutions. It requires genuine commitment, and a consensus that can be acted upon by each player in his or her particular sphere. In practice, it is society that determines whether supply is adequate to meet its needs.

The human dimension, which has been completely neglected so far, also has a role to play in the energy debate of a society seeking to find a long-term, sustainable development program. Respect for the three main criteria of sustainable development—diversity, equity and independence—is a prerequisite requiring active citizen participation from the beginning, and this involves proper information and funding.

As a result of this collective exercise, in which the rules must be clear to all, an informed consensus can begin to mature openly and professionally. This makes for a less controversial process, facilitates decision-making and paves the way for action at the local level.

Some American cities have already set an example as part of the "Sustainable City Project", involving San Francisco, Portland and San José among others, in which people try to think of new ways of conducting municipal affairs so as to save energy and reduce waste, thereby guaranteeing their quality of life and developing their local economy.

New England has also taken a step towards a complete opening up of the energy planning process through an MIT project. An advisory council made up of environmentalists and electricity producers, users and regulators integrate environmental and non-quantifiable considerations into their electrical-energy planning process.

The fundamental questioning caused by our current economic crises, to say nothing of future crises, will change our way of living as a society by restructuring the way in which the services we need are provided. How better to facilitate the transition than by opening up the decision-making process?

The changes required to deal with the pervasive crises we have caused through our negligence will require a mental and moral effort beside which any technical or financial

investment will pale. Humanity is facing a formidable test of its maturity and endurance that it absolutely must pass. It can do so only by reaching a global consciousness that will allow for a sustainable mode of development that will work because it is valid for everyone. Thank you.

Mr. Ross Harvey (Edmonton East): Excuse me, I do not speak French.

I must thank you at the outset for a most penetrating and stimulating presentation. You touched on a wide variety of the variables we must consider as we examine the matter of global warming, and did so in a fashion blessedly free of both hectoring and predetermined solutions.

I would like, however, to deal with it at a somewhat more mundane level, in my question at least, and that is the level of government funding for research, development, and demonstration of alternatives and efficiency projects. As you doubtless are aware, since 1984 that budget within the Energy, Mines and Resources Department has declined by 92%, from over $400 million to just under $40 million this year. I was wondering if you would care to comment on that trend in such funding and perhaps offer whatever advice you may have on where it might more usefully go in the future.

Ms Connor–Lajambe: I will reply in French. The situation you are referring to reveals a lack of knowledge of the environment and causes scandal among well–informed people. However, I think that the departments knew what they were doing. Now, they will be able to increase their budgets by 2000%, after this period where the funding virtually dried up.

.1650

The fact is that there is no other solution: We must earmark large amounts of money for conservation, if only to inform people about the considerable resources available to them. We must also renew the funding for the equipment that already exists, and which is already marginally profitable, to enable industry to sell in volume and to create an attractive technological niche for Canada as a whole. This is in fact an extremely important priority.

Mr. Johnson (Calgary North): I would like to add my welcome to Dr. Connor–Lajambe. It is a pleasure to have you here. I also appreciated your presentation.

I am concerned with this level playing field concept. As Mr. McNeil's slides showed, there are enormous taxes already on the fossil fuel industry, particularly the oil and gas industry, in fuel taxes, royalties, and so on. I am not sure that if we ascribe to the level playing field concept we are on the right track. I think it is much more important to look for certain goals.

I live in Mr. McNeil's world, and I am wanting to live in the world described by yourself and Dr. McLaren. But I want to get there in a logical way. If we say that the playing field should be level, and we take all the taxes off the oil and gas industry and all the royalties off, we may be opening Pandora's box. I think it is much more important to say that we have a

vision of where we want to go and it is government's responsibility to direct people towards that vision. To me that is the issue.

Now, my question for you is similar to the one I was leading to when I was talking to Mr. MacNeill. Is it appropriate in your mind for the government to set objectives and then to put bonuses and penalties on them? I was talking earlier about the automobile, but it could refer to utilities using carbon fuels and so on. If they reach certain objectives in their processes they will not be taxed; that if pollution exceeds that level, they will bear a heavy tax, but if they achieve better, they will have a marketable commodity they can sell to someone who is not achieving—a bonus penalty type of system where the government goes in and sets these objectives, and gradually, at a planned rate, not a mysterious rate, we crank these things down to achieve our objectives.

I am trying to look at how the government's role fits in with these objectives we have.

Mrs. Connor–Lajambe: Objectives must be set and they must go beyond the energy field. Canada and other countries must really understand that what they do at home has an impact elsewhere and that together we must undertake to build a new society. That is why I mentioned the Green Plan in my statement. It is an opportunity for Canadians to develop a vision. You are right in saying that once we have a vision, it is much easier to establish objectives and an approach that will lead to results without causing disruptions or upsets in a particular sector.

There are many solutions that can be tried in the form of regulations, financial penalties, taxes, and so on. There is no one single solution. We must look at various approaches. However, we must realize that when we make these decisions, their consequences will be felt not just by the industry itself, but by the people who work for that particular industry and who have no choice about that.

For example, like everyone else I certainly agree that we must reduce our use of fossil fuels. However, we must ensure that in so doing we do not make the poorest people suffer the most. There should be cutbacks in certain subsidies that are still going to industries that produce a great deal of waste or atmospheric pollution that cannot be cleaned up. We must procede logically by first removing the source of the problem, and progressively establishing the standards, objectives and possibly the penalties that will encourage people to reject these polluting materials in favour of environmentally acceptable alternatives. Have I answered your question?

.1655

Mr. Johnson: Not quite. The real question is: In addition to penalties, can we work a bonus system into the laws? A company that lowers its production of pollutants below the standard could be given a bonus, moving the overall average down.

Ms Connor–Lajambe: It's an attractive idea. I think we have to encourage people to do this type of thing. On the other hand, however, you should bear in mind that selling the right

to pollute—and that is what a pollution quota amounts to—has something a little immoral about it. We should make sure we are not sending out the wrong signals. We cannot put the whole environment on the market.

Mr. Foster (Algoma): You mentioned the environmental impact of cutting down trees. Are you talking about greater reforestation, or are you talking about stopping the cutting of trees for pulp and paper purposes, so that we do not publish *The Toronto Star*, but watch the television to get our news? What do you see as a viable policy direction with regard to the forestry industry?

My second question concerns the use of hydro-electric power and the construction of dams. I know there is an environmental cost when you create a dam for generating electricity, because you remove the trees. But at the same time, it has to be a more environmentally clean means of generating electricity than coal-fired generators or even natural-gas-fired generators. I am wondering where you come down on those two issues.

Dr. Connor-Lajambe: On the forestry issue, with all the recycling that has been going on, we will not have to cut our forests at the current rate. It is clearly unsustainable. Recycling is probably going to solve part of the problem. Another part of the problem could be solved by better management. No clear cut. These management techniques are implemented in other countries not as rich in resources. We have to compete with them. They have to compete with us. So I do not see that putting us at a disavantage at all.

.1700

Forestry is a very worrisome sector. I see that many of the things that are changing it are maybe coming not from Canada but from laws made in the U.S., for instance in recycling. We seem to be forced to protect our own resources because the others are wiser, sometimes, and provide a bit of a lesson for us.

On your second question, about hydro-electricity being cleaner than burning fuel, maybe at first sight it is. When you switch on your electric appliances, of course you do not notice the pollution. But as the Cree were saying in New York yesterday, each time you flip a switch you are destroying their way of life. It is not with carbon emissions, though I mentioned earlier that there are carbon emissions. Also, we are destroying a carbon sink.

But there is another aspect with megaprojects, and not just hydro-electric megaprojects, and it is the fact that they exert an enormous influence on a large amount of land, and in doing so they simplify the ecosystem in a way that may prove detrimental—maybe not today or tomorrow, but the accumulation of simplification of the ecosystem is destroying the diversity that has created the equilibrium we know now to be on this planet. We are fooling around with mechanisms in climate, and maybe part of that comes from huge dams here and there, which create microclimates. But all in all, the more we do.... Maybe at some point there is a threshold we do not know how to locate.

So rather than wait until it is too late, let us look at other ways of producing energy. And we have a lot. As I mentioned earlier, since we started looking at the demand side we

have discovered amounts of energy we did not know there were; and they are in our own backyard. We do not have to go and take the land of other people to do it.

Mr. Caccia: Dr Connor–Lajambe, your referred to decision–making autorities towards the end of your statement. This is a subject we have not really touched on today. If you have the time and the patience to go into it, we would be most grateful.

Ms Connor–Lajambe: Debate on most of the major problems in energy becomes very heated quite quickly. That is true of the debate on nuclear energy and the one on megaprojects. Most of the time, this happens because the people involved have not been involved in the debate from the outset. They have not received the information they should have, and they therefore think that decisions have been made in secret, behind closed doors, without their being consulted. Generally, conflicts of this type degenerate and either block or greatly delay the decision–making process.

Ordinary people are the ones who have to make decisions in the energy field. Most of the time, we are talking about choosing a car that does not pollute or an appliance that uses much less energy than another, for example. Since people have to make the decisions in their individual domestic or professional lives, the best thing is to get them involved from the beginning.

In places where this has been done for some time, it has been found that consultation not only defused the debate, but meant that it was conducted in a much more professional way. It generally meant that groups were given funding which enabled them to hire professionals or to do in–depth research on a particular subject. This speeded up the decision–making process and meant that people were aware of all aspects of the program from the outset, rather than hearing about them a year or two later.

.1705

Mr. Caccia: You mentioned the public consultation mechanisms, and said that they should be more open than they are now. I would like you to take into account the fact that there are decision mechanisms at the municipal, provincial and federal levels of government. What change would you envisage to these government mechanisms with a view to development of a new policy in the future?

Dr. Connor–Lajambe: There have already been some notable efforts. In the field of energy, we had the Energy Options exercise. That was a start. Even if it didn't satisfy everyone, it was a beginning.

And then there was the creation of the national round tables on the environment and the economy, which bring together people with different viewpoints in the hope that they will come up with innovative solutions. These mechanisms are relatively new and, for the moment, inconclusive, but they are the wave of the future. Those who have traditionally made the decisions have to get together with people from the other side who can contribute some real–world savvy.

Mr. Stevenson: In your comments you have made certain general comparisons of the overall real cost of various sources of energy for the production of electricity, and you referred to Ontario Hydro at one point, I believe. I had a little trouble in the transmission at that point, so I would like you to clarify that, just expand on what you said, in particular the relevance to comments on nuclear energy and how the real cost of that might compare with other sources, and also in light of government support for research in nuclear energy and the fact that we have not yet addressed the long-term disposal or storage of nuclear enery and how that impacts on the real cost in comparison to other sources of energy for electrical generation.

Dr. Connor-Lajambe: The study I was referring to was made, I think, for the Minister of Energy in Ontario. It is a supply curve showing the different costs of the different sources of electricity. This curve is interesting because it incorporates the demand side management techniques, whether it be better windows or better heating systems. So this curve shows this progression. However, it is only for electricity. It does not cover the whole energy field. If I remember correctly, nuclear energy would be at the farther right-hand side of the supply curve, which means it would be the highest cost of electricity to be produced. So it would be the last one to be chosen.

As far as nuclear energy is concerned, they still need to do a lot of research on disposal of waste. It has been qualified as a form of energy which is already outdated. Our CANDU has not been upgraded. That is why it is not a very interesting technology compared to all the demand-side management techniques.

.1710

Nevertheless, even if we do not do any more nuclear, we still have to deal with the waste, whether it be low-level or high-level waste. There is still a large amount of research to be done, so the people who are now actually working on nuclear reactors could very well be transferred and still work in the nuclear field, finding solutions for the problems which have been created.

Mr. Harvey: I would like to pose two questions. The first is essentially the same question I posed to Dr. Connor-Lajambe, that being whether or not you think the government would be prudent to reverse the cuts it has imposed on energy alternatives and efficiency in research and development demonstration over the last six years.

Second, I would like to pose to all three witnesses a fairly fundamental questions; that is, at present we live in a society founded on an economic system that must grow or collapse. Those are our two alternatives. Yet everything we are hearing today is telling us that we live in a closed room, with finite potentials. The question I would put to the three witnesses is: how are we to reconcile those apparently irreconcilable conditions?

Mr. McLaren: There are two questions and three answers, as you have six different points of view, I am sure.

It is prudent to go into energy R and D. That is exactly the answer. Today we are on the verge of being able to break into renewable energy sources. Let me give you a very quick example. The solar constant on a square metre of the earth can be multiplied out and you can work out a certain return of solar energy. The amount of solar energy coming to the earth is absolutely staggering. For example, James Bay will produce 26 of what the engineers call gigawatts. That will take an area about the size of France and it is an efficient operation.

If you took photovoltaics and set up a system by which you could collect 1% of the solar energy falling on a square metre, which is feasible, allowing for night and a bad day of weather and all the rest of it—it could be 1% or you could halve it; it does not matter—then, it would require an area of 2000 square kilometres—that is, 44 x 44 km—an area which is 1/3000 of the area of France, which would give you the same equivalent in watts.

That is may be an exaggerated case, but as was said quite a while ago, there are only two elements that man uses on earth: one is high entropy materials; the other, the heat of the sun. You use high entropy materials plus the imperial system. A few days heat of the sun is the equivalent of all the rest in terms of energy availability, so obviously we have to go solar. Remember, today we are using fossil fuels which are solar energy stored over about 400 million years. When that is gone, it is gone forever. That is the first question.

Quickly, the second thing on growth: throughout the whole of history, with civilizations rising and falling and conquest and change, man has very frequently lived quite happily for a very long time in no-growth economies. The Romans did. You can live in a no-growth economy. I am not going to get into the techniques. I am not an economist. There is surely something mythical about the fact we have to grow. economy. I am not going to get into the techniques. I am not an economist, but there is surely something mythical about the fact we have to grow. There is one way around it, of course, and some economists are beginning to apply it. You change the meaning of the word "growth", and then you are quite happy. We can grow intellectually, or we can grow in some other ways.

.1715

If we talk about how much stuff you use—how much entropy materials you take out of the environment—then obviously there is a limit. If we pretend we want to give it to the other 80% of the world, then we have to reduce. Therefore, we have to realize growth of entropy and waste discharge not only has to stabilize, but may have to be reduced. Then we can have an economic system to look after that. I do not believe we would be any worse off if we did have a no-growth economy.

Mr. McNeil: I appreciate the fact that, following Dr. McLaren, you are really asking for a second opinion. I am in the luxury seat of being able to say I either agree or I do not agree. Certainly his words are very well taken.

I really cannot suggest the CAA or the automobile sector has spoken to the issue in the philosophical sense you are perhaps asking. When you look at it from a very practical point

of view, from the very basic question you have asked: is there room for research and development? Should we be looking at it as a very high priority effort in this country? The answer is a resounding and definite "yes". There is absolutely no question alternate sources of energy are important within the transportation sector, as they are important everywhere right across the way.

In terms of the other side of it, when you are asking about the growth or collapse, and eventually you have the choice of either/or, I also would concur that growth is really just a term. There is a capability within mankind or humankind to continue to expand, to continue to maintain. It is what the sustainable development debate is all about, and it is the issue being approached within sustainable development. I would simply suggest that is a greater philosophical argument than perhaps I can respond to.

Dr. Connor–Lajambe: Very briefly, I think the fact we are asking whether we can continue growing or are we going to collapse shows a progress, somehow. However, the way we are finding answers is a bit disturbing, because the answer is sustainable development, but what is sustainable development? We have heard that term for the last three years, and everybody puts whatever he wants on it.

What we heard yesterday at Earth Day is different, and I think it is what we should be listening to. That is why I feel the most important part of the debate is not more supply or more demand; it is what people want to do. What are they willing to do? Eventually, if we are not all agreed as to what sustainable development means for us—in fact, to cut down—if we do not understand it and do not implement it...people are saying it; the public is saying it; why can we not say it at a political level? At the industrial level, why can we not implement it? As long as we put sustainable development in our own terms instead of putting it in terms of what the planet can take, it is going to take a while.

Maybe a lot of you do not see it, but again I go back to the Green Plan—we have to make it an exercise of mental and moral dimension. We have to take it seriously for the next generation. Otherwise, we are going to collapse.

We have been fortunate to work professionally with environmental groups like Friends of the Earth and other groups, who have been working since 1976 or 1978 on alternative plans, like soft energy paths. Quite frankly, it irritates a lot of people, because "soft" certainly does not fit with the competitive edge we all are supposed to have. Soft energy paths, at the moment, seem to be the only way of rethinking the way we are going about our professional lives.

.1720

Some people are working on it at universities now. I want to mention Waterloo. There is a big sustainable society project using computers and what have you. It is the most scientific project I know of and it is happening in Canada. We have to help those young people and give them more attention because that might be where the solution is—an alternative way of developing.

Mr. Brightwell (Perth—Wellington—Waterloo): I have a technical question. I think it might be answerable here. If not, I will go someplace else. It is no problem.

When I go out as a recreational driver on a Sunday afternoon and look at my constituency or whatever, how many pounds of carbon am I pushing out the back end of my car for every gallon of gas I use? Will I be better off buying the high-octane gas? Will I be putting out more carbon or less carbon with the high-octane gas?

Mr. McNeil: You are right, it is a highly technical question and I fortunately have some people here who might be able to provide you with the answers.

In terms of the amount of carbon you are putting out the back of your tailpipe when you are taking that pleasure drive...I would not suggest that driving around your constituency meeting with people is a pleasure drive.

Mr. Brightwell: I did not say I was meeting with people, I was just looking at the grand country it is.

Mr. McNeil: That is more work related. However, I will certainly get the amount of emissions consumed per gallon or per litre to you. It is just a figure that does not come to mind at the moment. With respect to other pollutants, I can provide you with a full list.

Mr. Brightwell: Is there an advantage in high-octane gas, as I think PetroCan says there is?

Mr. McNeil: The higher-octane gas burns cleaner and is certainly an advantage as it has further additives in it.

Mr. Angus: I want to pose a question to all three witnesses. It may be totally inappropriate if I did not, given we are where the transport committee gave lengthy consideration to a decision by this government to cut our rail passenger services by 50%.

I would like the witnesses to comment on what they think the environmental impact of that decision, which shifted approximately one million passenger trips per year to automobiles...along with the shift throughout the whole system.

Mr. McNeil: The Canadian Automobile Association and all persons who are interested in transportation and the conveniences and practicalities of it were disappointed with a number of the initiatives of this government when it came to the VIA Rail cutbacks and certainly with the amount of traffic that generated on our roads and highways. At this time, roads and highways are facing over-capacity in many areas and certainly are in a deplorable state in many others.

So I really think the environmental impact is one which perhaps could have been considered at greater length and with greater depth. There will be increased environmental damage as a result of the government initiatives, but I am certain they weighed some of that in the decision. One million passenger trips in a year going into the mode of vehicles or automobiles is a significant amount. I would have to do some calculations to determine

exactly what that means in terms of distances and the like, but it will have an impact on the environment.

Dr. Connor–Lajambe: I am not sure that the trains are so clean, even those that can spare a few trips. I think they use diesel, which is quite polluting. Nevertheless, we ought to see that transport is often not just a commodity, it is a service and as such it should not be judged solely on economic viability. Transport should also be considered as rendering a service to the community, especially when communities are isolated.

.1725

The train service may be expensive to restore once it has been cut, but we should not be upset if it costs a lot of money, because we have been able to give so much funding to industries and technologies, such as military investments, which are now more or less useless. We could cut another CF–18 here and there and do a good job on restoring public transport.

Dr. McLaren: The discussion is on the right track, but my own point of view on public versus private transportation is that public transportation should always be encouraged whenever possible, because we live in communities and the more we use public transportation or public services of all kinds, the more civilized lives we will live, rather than shuting ourselves up in our cars and in effect taking our homes with us, because a car is a home of a sort. When we travel, we do so with our fellows, and public transportation is thus a very important psychological entity in terms of humanity, as well as in terms of making good economic and environmental sense.

Mr. Johnson: I would like to continue briefly along the line I was on because I was rather disappointed with Dr. Connor–Lajambe's comment that it might be immoral to sell environmental credits.

She may wish to respond as well, but I would like to direct a question primarily to Mr. MacNeil. Dr. McLaren may also want to add his comments.

As a representative of a classical special–interest group, if you do not mind, because I still see you that way, would you not be in favour of legislation that contains both credits and debits, and thus incentive is built–in along with the objectives for environmental control?

Mr. MacNeil: I appreciate the opportunity to respond again because the first time you asked that question the noise was so great back here that I did not catch exactly what you said.

You were talking about penalties versus rewards and of incorporating those measures on the same basis whereby someone who actually succeeds in achieving or bettering a certain objective is rewarded for doing so or are penalized if they do not meet that objective.

Conceptually, such a system sounds wonderful and reasonably fair. I suppose the difficulty is found in the factor of who sets the objectives, targets and goals one has to aspire to.

Mr. Johnson: The legislators would obviously be setting them.

Mr. MacNeil: Therein lies the rub. In certain cases, that approach may be fair and very well intended. On the other hand, as a case in point or an example, government has established or wishes to establish a certain percentage of reductions of smog. So they have suggested they move into new alternate energies. This is particularly occurring in the U.S..

They are finding that some of the combined or blended fuels they are using, either ethanol or methanol or any combination thereof, are greater contributors to other sides of the pollution equation than to the actual reduction in smog, which they are accomplishing by introducing something else.

So while the approach may be well intended and well founded, there may be other consequences to trying to set those kinds of objectives in one area and you may forsake something in another area. The concept is excellent and is very much a disciplinary one, but it is very difficult to control.

Mr. Johnson: Trust us.

.1730

The Co-Chairman: But if Mr. Johnson is reasonable, realistic, and reachable, I think that is all right.

Mr. McNeil: There you go. You need three hours and then you are all set.

The Co-Chairman: Mr. Johnson made some comments at the beginning that Ms Connor-Lajambe may want to answer. They were about how we should not or buy environment standards.

Dr. Connor-Lajambe: There are people who will say we can solve problems of environmental dimensions with the market. I am not convinced of that. I think too many of the problems that have been created for the environment have come from the fact that the market has progressively extended into the global commons. I doubt the market mechanism can solve that. Possibly it could aggravate it.

Somehow in all this, on this earth, there must still be something sacred. I am not sure you will find it would be so acceptable. We have other means of protecting the environment without slicing it further. We have imagination. I think we can work on that.

Mr. Caccia: Dr. McLaren earlier made a comment on economic growth, and I would like to probe him with the following question.

Dr. McLaren, as you told us earlier today, the world population is increasing at roughly 19 million a year. If that is so, would you agree that if we do not have economic growth we

have to divide the same stagnant economic pie amongst an increasing number of individuals on this planet?

Dr. McLaren: One says, and you will hear the word quite often, we have to restore "equity". People talk about equity, but to start with, it is obviously impossible that the whole of China should drive cars, as we do. It is obviously impossible. There is just no conceivable way it could be done. Anyway, they do not have enough oil.

We have to recognize that if you are going to give any kind of equity or any sort of balance to prevent the misery that is increasing very rapidly now on the famine side of things and so forth you have to arrive at a certain standard of living, or attempt to allow people to achieve a certain standard of living. But that standard of living, if we balanced out at a certain population, whatever it might be, would be very, very, very much lower, not necessarily in the quality of life, of course, but in material usage, than the one we have now, because we are living at a privileged time as the privileged few. Indeed, we are living in the twilight years of this time of privilege, because we are running out of the capacity to absorb our own waste. If you look at Los Angeles, for instance, Los Angeles is ridiculous in a civilized country. So is Mexico City.

How you balance these things...all you can do is to observe and say they are doing these things. It is not a question of deciding whether you put in economic laws to make us use less gasoline or not. It is a question of recognizing that we have to stop using the resources if we wish the rest of the world to improve their lot. If not, then we merely sit around and wait for the end, because we cannot build walls. There are no walls in the world any more. We cannot say, well, we will do this regardless of what is going on in the rest of the world.

Mr. Caccia: But in this scenario of no economic growth that is an interesting alternative.

Dr. McLaren: Well, we are talking about economic growth somewhere in the world.

Mr. Caccia: Exactly. Are you then suggesting there should be a shift in growth so the total global growth perhaps comes to a halt, as you would propose, but there would be a shift in economic activities from the northern to the southern hemisphere? Is that what you are suggesting?

.1735

Dr. McLaren: I am not advocating anything, I am merely saying that logically we can go on using resources the way we are now and expect to improve the lot of our fellow men in the southern hemisphere. You cannot do it. The resources are not there. That is perfectly clear.

So what do you do? As I said, with these 90 million babies we are producing—it is actually about 120 million; about a third of them will die in the first year so the net gain is only 90 million—we are bringing a very large degree of misery into the world. The area of starvation is expanding.

We may choose to ignore that, but enlightened self–interest says the instabilities this is going to create will unsettle the global status quo much more than the arms race between the Soviet Union and the United States ever did. We are coming to a time of state terrorism, mass starvation, mass migrations and so forth. If we do not adjust to the kind of things going on in the world, our own little enclave will last only a certain time and then we will sink into the general chaos. This is not doom–saying, it is just recognizing the logical progression and acceleration of everything we are doing. When do you say you have enough?

Mr. Caccia: Could you ever envisage a political situation in the world where politicians get elected on a platform of no–growth?

Dr. McLaren: It is just a question of how you describe it. No–growth is a wicked and evil word among economists, but there are now several very respectable economists in the U.S. writing textbooks on no growth. Rogin, perhaps one of the cleverest economists, was the man who introduced thermodynamics into economic theory, and he was no–growth. It is just a gimmick phrase, like "sustainable development".

Growth and no–growth: economists talk about growth because they have this primitive system of recycling. This is a classical system, of course—they are beginning to get out of it. They do not consider the fact that we are inside a larger system—the ecological environment—and we are taking things in and excreting them again. We have to live in our own filth and we have to delve deeper and deeper into the earth to get our resources. At the same time, our renewable resources are being destroyed at an ever–increasing rate.

Mrs. Catterall (Ottawa West): I would like to get a little more concrete. One of things that has not received nearly enough attention in all the public discussion on the environment is the connection with issues of developing countries. Call it the north–south relationship, if you will. That is evident when we see the high percentage of people who are very supportive of government action—at whatever cost—on the environment, and yet who think we should cut foreign aid. Obviously public awareness of the connection between the two is not there at all.

Just as I am worried about and think something needs to be done about the export of second and third generation military technology when it is no longer useful to the developed nations, so am I concerned about the export of damaging second and third generation technology as we in North America start to look at more environmentally sound ways of doing things. i wish I could believe Dr. McLaren when he says it is impossible that the Chinese chould drive cars to the same extent we do. I think it is entirely possible, and how can we avoid it?

It is fine to stop the use of CFCs in Canada, but what good does that do if we allow those same CFCs to be exported? That is what is happening. The use of CFC's is increasing. We are now finding that DDT, which we banned nearly two decades ago, is coming back to us. Obviously that does nothing to solve the problem. What action do you, particularly, Dr. McLaren, feel that goverment needs to be taking in specific areas to make sure we are not

simply exporting the production of all the luxuries we like to enjoy and all the bad technology we have used to get to them?

.1740

Dr. McLaren: Once again, considering enlightened self-interest, you cannot build walls. There is no ceiling over us. If we export our poisons they come back in again. The Arctic whales have poisons in them that come from Lord knows where. Arctic haze comes from Europe. We are living in one single, little area.

But as for this business of the military technology and so forth, of course, people are talking about the peace dividend. I mean, $1 trillion a year is being spent on arms. That is a staggering amount.

We were discussing this just the other day—90 or so people down at the Global Change meeting in Toronto. Supposing that money was available to spend on all the problems that are facing the world in terms of pollution and the environment—including dirty water; 2 billion people drink dirty water with all sorts of diseases in it—and so forth, how can you clean up these things? Could you do that with $1 trillion a year?

The answer is that you could do it and hardly notice it. The total runs into billions, perhaps a few hundred billion, of what you have to spend if you want to do things. That is only approaching 10% or 15% or 20% of a trillion.

The other thing is that we do not need to consider that even if peace did break out we would have to fire all the soldiers and so forth. In fact, all countries have an enormously useful body of people in the military. They are highly trained, disciplined, intelligent, show leadership and everything else, if we wish to slowly change them over to doing useful things for the environment, in fighting a war against the ghastly things that are happening to the planet. Here again, a lot of the military expediture could go on being spent in terms of the generals and the privates. They would be doing a job that might give them even more satisfaction than learning how to shoot guns.

This is just sort of a suggestion, that the upsets required are not going to be that great. When we make our switches and changes, it is not going to be that great. It is not going to be that expensive.

The amount of money that we are subsidizing nuclear with...as somebody pointed out, if you plan a nuclear station and it therefore stops you from using an oil- or coal-fired furnace to produce the same amount of energy, the nuclear station may be, in effect, causing several times as much carbon in the atmosphere by preventing energy economy in the country.

Ontario is doing this now. They are building new nuclear stations to produce energy they do not need. This is an enormously unbalanced situation. It is going on all around the world. We are doing things we do not need to do.

In terms of the citizen, it does not make a difference in terms of his quality of life. In fact, the quality of life probably peaked about 30 or 40 years ago, now that we are living in these dirty cities and high-stress environments, driving to work in crowded cities and so forth.

All the things that have to be done are not things to be frightened of. They are not things to be frightened of in industry. God knows the amount of money that is going to have to be spent on switching over to different kinds of things. If you make good fighter aircraft, then for God's sake, surely you could make good systems for trapping solar energy.

By the way, the photovoltaic system is now overlapping in price per unit of energy the most expensive nuclear, so we are now crossing over. That is before a big R-D-and-D effort has ever been made.

R-D-and-D means a lot of industry spending a lot of money and a lot of research and a lot of technology. That is all they want to do. That satisfies them. It is just a question of not being frightened of the kinds of changes that have to be made.

.1745

The Co-Chairman: Thank you very much. Charles and I have decided that perhaps there are a couple of questions from the public. Is anyone here visiting in our audience who would care to pose a question to either of our experts?

Mr. John McConnell (Individual Presentation): It is such a joy and a delight to be here. I feel the discussions you are having are deeply needed in communities all over the world. The main thrust of the discussion here has I think made us feel the future is very bleak.

Incidentally, I was founder of Earth Day, and on our board we have 33 Nobel laureates. Margaret Mead and I formed the Earth Society Foundation. Bucky Fuller used to talk to us about the possibilities of the future.

As far as I am concerned, all we need in the world is to open our eyes and see the alternatives and then mobilize effort everywhere in the moral equivalent of war for the rejuvenation of our planet.

You were talking about numbers. I remember years ago we figured out that one billion minutes went back to just about the time when Jesus Christ was on our planet. So when we talk about billions of dollars we have a better feeling about what it means. Do any of you by any chance have an idea of what a trillion seconds would be in years? That would fascinate me.

Dr. McLaren, I again wonder, when we talk about how we have to cut down on everything...and of course we have to have a sustainable future, and I am all for no growth as far as the things that are polluting and destroying are concerned. With knowledge we want constant growth. With many other things I like the quote that the beautiful thing about information is that I can give it to you and keep it at the same time; I do not lose it when I give it to you. But when we take things out of the planet, they are gone.

Another great quote is that we used to think we could throw things away. Then we discovered suddenly that there was no "away"; there is no place to throw.

I just wonder, though, as far as the assets of our planet are concerned, when we think of the raw materials, natural resources, gene banks, and all the rest...if somebody figured out the total assets, I have a hunch they would be equivalent to $1 million for every family on earth.

I do not know, but it seems to me we are at a crossroads where what is needed is hope. We have been following the road of despair. I believe with our technology and raw materials and natural resources, and now with a new world view that we are going to take care of our planet and be trustees and responsible caretakers of Earth, we can find answers to all the questions that have been discussed here.

I guess that is more of a remark than a question, but if anybody has any estimate of what the assets of our planet are, I would like to hear it.

The Co-Chairman: Thank you very much. We certainly are pleased to have you here today, Mr. McConnell.

Dr. McLaren: I heard this gentleman yesterday. He and I were on the same platform at Earth Day, and it was a wonderful thing to hear him.

I thought it was wonderful luck for us to have met you, sir, and to know you were there.

The Co-Chairman: And having a vision.

Dr. McLaren: Yes, and having a vision.

I would merely say this, that the question of unlimited resources and delving deeper into the Earth and this, that, and the other...it is not a very long-range future.

The Co-Chairman: Are there any other questions from our audience?

.1750

Questioner: I am a Bahai, and an environmentalist. I certainly believe that we have a moral obligation towards our planet, and a moral solution, probably. But I disagree slightly with Dr. Connor-Lajambe because I think that the idea of a bonus, a reward and a punishment system, is a good idea, in the sense that you cannot get rid of the opium problems simply by wishing them away or by even praying them away. Sometimes it takes fire to fight fire. I think that the idea of the bonus offered is not such a bad idea.

The Co-Chairman: Great. I think, Mr. Johnson, this is what you were referring to, to set achievable goals and for those people who over-achieve there are bonuses, and those people who do not achieve are penalized.

Dr. Connor-Lajambe: A bonus is different from not having a sanction. I think if you, for instance, ever choose a car which does not pollute, there you do not pay. If you choose a car which consumes a lot of gas and pollutes, there you should be penalized. The other thing could be seen as a bonus, if you want.

Mr. Johnson: If I may just comment briefly, I do not think you can choose a car that does not pollute. That was the point I was trying to make. If the government sets a standard and you choose a car that is better than the standard, in which case when you license that car each year you get a bonus, or if you choose one which is worse than the standard you pay the penalty.

That was the whole point I was trying to get across. It is up to government to set—in my view, that is our job—the direction, and we have to give people incentive to over-achieve. That way we will design cars that will keep Mr. McNeil on the road forever. It will eventually run on solar energy.

Mr. McNeil: If I may add just one small comment to that, we already have, in Ontario, as you know, a gas-guzzler tax. That is where government establishes a certain performance in fuel consumption, and if the car does not match that then there is a penalty on that car. All those that succeed in being better than that standard can go on to market without that penalty.

Dr. Connor-Lajambe: The down incentives which are not necessarily heights to pollute—we can devise those too.

Mr. Hollands (Chairman, Gloucester Arts Board): Madam Chairman, I would just like to disagree briefly with my friend Hélène Connor-Lajambe. The mere existence of one more creature in a ecosystem affects that ecosystem. So our mere existence as humans on this earth and the next one changes the ecosystem. The notion that we can be here and not affect a local or a global ecosystem is, in my view, false. It is a rather philosophical point, perhaps, Madam Chairman, but it means we have to come to terms with the fact that our mere existence as people, and in particular, our use of machines and energy, influence the condition of our global ecosystem.

That being said, what we have to choose as a society, I would submit, is what kind of an ecosystem we would be comfortable with and towards which we should go. To answer the specific question that is raised, or to address the specific question that is raised here, if one thinks, for example, about seeking, first of all, a reduction in the emissions of carbon dioxide, we might agree, as a Canadian society, as a global society, on a first level of emissions world-wide that we would try to reach. In using the current methods of decision-making, governmental, corporate, and individual, we respond to the workings of our marketplace as well as our beliefs and all those other value systems.

The committee might wish to consider the experience of the United States in using tradeable emission permits in trying to deal with emissions there. The United States delegation at a recent meeting of the OECD on climate change policy—we do not very often agree with the United States delegations in these places, but it is an idea worth consideration—suggested that the use of tradeable emissions permits might be one very useful tool in coming to terms with the greenhouse gases.

.1755

Mrs. Catterall: I may be the sole voice here, but I think the whole concept of permits to pollute is offensive and immoral, almost. I think that is what Dr. Connor–Lajambe was talking about. I would like some clear and simple explanations of what they could possibly accomplish.

Dr. Connor–Lajambe: I agree that as soon as we are on earth, we pollute. We pollute even before that. I would not deny that we contribute to the increasing entropy in every step we take. I also agree that we need these incentives, and that these incentives should be put clearly before the sanctions are applied, so that people have a clear idea of the rules of the game. I agree totally with that.

My point is that this trade in rights to pollute is similar to many trades that are not going properly. It looks a bit like the drug trade, in a way. In the way it is going to be dealt with, I think it is overly complicated. It could be done much better by clearly making available information before people are in a position to do their own thing.

We can devise incentives that would not translate into allowing people to keep on doing what they have been doing for so many years. We can devise incentives that would not require this wheeling and dealing where finally the government is going to lose control.

I have been looking at this and it might be better than what we have now. I am not saying that. But in the end, I do not think that is the solution we want to go towards. We can devise other ways of convincing people to do the right thing, without paying them when they buy a right to pollute.

Mr. Angus: Mr. McNeil, you pointed out how low cars were, but if you add up all of the vehicles, you are talking about 30% of the contributors.

Mr. McNeil: Trucks and buses.

Mr. Angus: Yes, anything on rubber, basically.

Mr. McNeil: We are talking carbon dioxide.

Mr. Angus: I am told that you were at the environment committee not too long ago, and you indicated that Canada produces up to 1500 electric–powered vehicles a year and sells them in the United States. I would like you to comment on that.

Secondly, if I am not mistaken, you were on the radio last week talking about the the impact of inappropriately maintained vehicles on the environment. I am wondering whether the CAA would be willing to push for new warranty standards, so that the warranty period would be long enough to entice those "cheapos" out there to get their cars fixed sooner.

Mr. McNeil: On the electric vehicles, I will get back to you on a personal level. But we understand that there is a manufacturer in Canada providing electric vehicles to the U.S., particularly California, on a special order. We had promised the environment committee to

get back to all of the committee members with the details, and I am sure we will be following that up very quickly.

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The second part of your question was very important indeed. I am not so certain that auto manufacturers or vehicule manufacturers are to be held responsible—

Mr. Angus: No, I am not saying that.

Mr. McNeil: —in a sense, by warrantying the emissions. I think there is a better role for the CAA as an organization to play and for government to play or whomever, and that is simply to support the implementation of mandatory inspections, maybe yearly, bi-annually, whatever. Unless those inspections are passed, your vehicule is not allowed on that road.

We have safety inspections. In terms of pollution inspections or emission inspections, that is the way to go. This would then force a person, like yourself, who may be a little tardy in getting into the inspection centre...if you do not have that sticker on your window, sorry.

Mr. Angus: What you are suggesting can be fairly bureaucratic. If it was in place as a preventative measure so that there was no economic disincentive to go in and do the repairs on a more regular basis of those parts that contribute to the environment in a negative way...even if I had to pay more upfront when I purchased my automobile.

You mentioned earlier the $500 that currently is on the price tag, and another $200 to come. I quite frankly would be willing to pay extra, almost like insurance, to cover the warranty on a mandatory basis long past the time when I would normally question maintaining that motor or that exhaust system instead of just letting it limp along until I get a new car.

The Co-Chairman: You heard it here.

Mr. McNeil: I heard it hear first. I think what you are suggesting is an extended warranty as a mandatory purchase to maintain the emission standards of that vehicule through time beyond the warranty period of the new vehicle. I think you run into all sorts of difficulties in ensuring that this individual then takes it in for inspection. You may as well simply not have that kind of a restriction or penalty, because it is an upfront penalty.

Even though you are getting something for it down the road, I think you are better off to put a proper inspection procedure in place. It does not have to be bureaucratic. After all, it can be done through the Canadian Automobile Association and we can guarantee it will not be bureaucratic. But it will be effective and it will work well.

Mr. Angus: Only if you remember—

Mr. McNeil: We had one on a book, now we have a commercial on CAA.

The Co-Chairman: On behalf of Mr. Langlois, I want to thank you, Dr. McLaren, Mr. McNeil and also Dr. Connor-Lajambe for being with us this afternoon and participating in our forum.

We will have the fisheries committee, the forestry committee and the Standing Committee on Agriculture with witnesses later. Tomorrow morning, there will be a session from 9.45 to 11.45 and then the Minister of the Environment will be closing the ceremonies at noon.

The meeting is adjourned to the call of the Chair.

JOINT COMMITTEE SESSION II

Agriculture

The Sub–Committee on Fisheries

and

The Sub–Committee on Forestry

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The Chairman: Order!

Good evening, ladies and gentlemen. Welcome to this forum on global climate change.

We are honoured to have with us tonight three eminent people, Mrs. Elaine Wheaton, head scientist for the Climatology Section at the Sasakatchewan Research Council, for agricultural prroblems; Dr. Jag Maini, Assistant Deputy Minister, Policy, Forestry Canada; Dr. Jean Boulva, Director of the Maurice Lamontagne Institute in Quebec. In your little booklet, you have supplementary information on our three guests.

I would ask Dr. Boulva to be the lead speaker for tonight.

Mr. Jean Boulva (Director, Maurice Lamontagne Institute, Fisheries and Oceans): Ladies and gentlemen, it is with great pleasure that I take the opportunity tonight to talk to you about global warming and its impact on fisheries and oceans. I will first talk about hypotheses concerning climate and oceans and then describe its impact on the oceans as well as on Canada's inland waters as well as the impact on Canadian fisheries. I will then talk about the importance of co-operative research and conclude by summarizing the main points and talking about the major steps to be taken.

It is important to the remember during this presentation that the hypotheses and scenarios being looked at are limited by the very restricted capacity of presently available climate models. An important part of this presentation will have to deal with oceans because understanding ocean processes is essential to establish the future of world fisheries as well as the probable evolution of our atmosphere.

Let us look at the main hypotheses on climate and oceans. According to present trends, the supposition is that atmospheric CO_2 will double within the next 100 years which, according to the most widely accepted hypothesis, will increase global warming. Oceans are important for the climate both as vast reservoirs of heat as well as a trap for carbon gases. They cover almost 3/4 of the earth's surface and the average depth is around 3.5 kilometres.

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It is recognized that the modeling of climate changes is limited by our limited knowledge of the oceans. For example, we don't have very good quantification of ocean heat exchange from the tropics to the poles. According to the vague data we do have, this transfer can be anywhere from 25% to 50%. It is important to get the specific percentage. On the other hand, it is estimated that oceans transfers as much heat to the poles as the atmosphere.

According to many experts, one of the consequences of global warming could be a threefold increase in temperatures in the north as compared to the tropics. Some mention a 6 degree Celcius increase in winter in Canada, the warming being more pronounced in the

Arctic. We will also see warmer oceans and lakes, an increase in our sea level of anywhere from 20 centimetres to 1.5 metres over the next 50 to 100 years, mainly due to the melting of glaciers and thermal expansion of the oceans; in other words, as the water mass warms up, it would increase in volume. The winter ice line will also move further north. The Gulf of St. Lawrence, for example, could be ice-free year round. Sea water will be less salty because of melting glaciers. Oceans will absorb less carbon dioxide. The water being warmer, it retains less of the dissolved gas. Storms will probably be more frequent with the warmer oceans and atmosphere liberating accumulated energy more frequently.

As for the rise in sea level, it might be damageable for many of the earth's lower lying areas. For example, in the Pacific, measurements have shown that since 1960 there has been an increase of 10 centimetres in sea level as compared to 15 centimetres over the previous 80 to 100 years. A warming of 1.8 degrees Celcius in sea surface temperature has also been noted and this observation was corroborated in 1989 by a study of satellite data, which is not the one that was spoken about this morning. The conclusion leans towards an acceleration of these trends.

Another area of concern is the decrease in the ozone layer that could have a major impact on the capacity of oceans to eliminate carbon dioxide. More ultraviolet rays are penetrating the surface of the oceans and affecting phytoplancton which is a microscopic plant that is able to absorb carbon dioxide, transform the carbon into an organic material and free oxygen, which means that the oceans ensure the renewal of a lot of the oxygen we are breathing. Therefore with less photosynthesis through phytoplancton, less plancton will be produced and marine productivity will decrease. The result of this increase in ultraviolet rays may be less carbon dioxide absorbed and falling as sedimentation to the bottom of the seas. So you see here, how the ozone layer problem could also contribute to global warming.

This global warming will impose new constraints on our coastal environment and its users. The combination of a rise in sea level and more frequent storms could increase destruction in coastal areas. The storms that occured in Europe last February could become the rule rather than the exception. With less ice on the sea, we will see an impact on many polar species, some of them fish, and marine mammals that have taken thousands of years to adapt to this hostile environment. The situation will be worse in the Arctic where the whole ecosystem depends on the presence of ice.

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On the other hand, there are positive aspects. Warming could increase the habitat range of warm water species and fishing harbors would not stay frozen as long. However, glacier melt would generate more icebergs which means increased risk for navigation and off-shore oil production. We forsee dryer summers, more frequent droughts, except in the Arctic and the south-east, and higher precipitation in winter in the west.

The map indicates anticipated changes in the area of precipitation. To these forecasts we should add increased evaporation as a result of higher temperatures. For example, the annual rainfall on Canada's west coast would increase between 200 and 400 millimeters.

There is a strong probability that anticipated climate changes will have a major impact on our fisheries. There will be a displacement towards the north of many commercial species, which could bring more southern species up into our waters. For example, some species might become more abundant, with a different distribution, species such as the common squid and maquerel in the Atlantic and European hake and long-finned albacore in the Pacific. The decrease in primary production on Canada's Atlantic coast might affect the abundance of commercial stocks like cod.

Salt marshes contributing to the food chain of marine species could change. Often those marshes serve as nurseries for fishelings. They might not have the time to regenerate if the seas rise too rapidly.

The change in wind patterns would result in a lowered mean wind velocity with a decrease in productivity in coastal areas attributable to slower upward movement of deeper waters rich in nutrients essential to plancton.

Another consequence would be the possibility of severe damage to infrastructures along coastal areas because of more frequent storms. There would be interference and increased risk for fishing activity, and fishermen would lose more days because of bad weather. On the other hand, aquiculture might benefit from warmer waters and diminishing ice, which would translate into faster fish growth and, in the Atlantic, in more possible sites for that industry.

However, greater stratification of the water column might favour toxic algae. This phenomenon would be caused by less salty and warmer water remaining on the surface and weaker winds than is presently the case, limiting the stirring effect on these waters.

What could really happen offshore? We can get a vague idea of this if we examine the a half degree centigrade increase to 2.5 degrees in sea temperature during the 40's and 50's in the Golfe of Maine. Certain species only moved north and there was no evident major change in the fauna makeup. After that, there was a cooling off and fauna distribution returned to normal. As for fresh water, it is estimated that over 30 species might invade the Great Lakes from the south. In the worst case scenario, Lake Manitoba could dry up and Lake Winnipeg shrink considerably.

Now a few words on the importance of research and especially scientific co-operation in this area.

Although the decrease in CO_2 and other gas emissions contributing to the green house effect are the number one priority, research on the processes involved remains essential if we want to understand what just might happen. The areas requiring the most efforts are the following.

We have to better predict the impact of climate change on maritime fisheries because of the socio-economic nature of this activity. A better understanding of the ocean processes and of the adaptability of fish species is required to allow the generation of realistic predictive models. Knowledge is at the present time insufficient to predict the reaction of most marine species to change. We must also better understand the variability of tomorrow's climate.

.1945

It should be pointed out that more frequent extreme conditions would be more damageable to fisheries than a gradual change. Our forecasting capabilities concerning ocean climate changes are limited and primitive and this restricts even more the exactness of atmosphere climate forecasting.

The Arctic Ocean is perhaps an important factor for monitoring climate change, but very little research is being done there. We should think about the fact that it's in the polar regions that the cooler waters, thus the denser waters, those laden with CO2, plunge to great depths. Together with the absorption by phytoplancton that I spoke about earlier, we have there the two ocean processes that help decrease carbon dioxide in the atmosphere.

Canada should be doing more research on ocean climate at an international level especially concerning important programs like the experiment on world ocean movements and JGOFS, the Joint Global Ocean Flux Study. Our country played an important role in setting up these programs but, at the present time, is limiting its research activity. The possible spinoffs for Canada are tremendous in the areas of modeling and computerization, amongst others. Finally, I should like to mention the strong cooperation of government laboratories with universities and the Natural Sciences and Engineering Research Council of Canada in the ECOM and JGOFS programs.

In summary, global warming will probably result in warmer waters, an increase in sea level and a change in current patterns and salinity. This will probably impact significantly on Canadian fisheries. The assessment of this impact requires more study and scientific data. One cannot count on present extrapolations on global warming. Amongst other things, Canada must improve its capacity in the area of modeling ocean currents on a large scale. World interest in global warming and its impact also represents a potential market for Canada. Finally, let us remember that the Department of Fisheries and Oceans is active in the area of research initiatives concerning climate changes and together with numerous partners is developing a Canadian program on ocean climate.

What action is urgently needed? We must especially increase research on the effects of ocean warming on the climate by encouraging, amongst other things, programs such as the JGOFS and ECOM. Canada must become an important partner within the framework of national and international projects. We must increase research on the effects of environmental changes on commercial species of fish. We must also come up with better predictions concerning the consequences of a rise in sea level and more frequent storms on

the safety of coastal areas. We must at all costs gain a better understanding of the role played by Arctic seas in the context of a warming climate. Finally, it is essential to improve our modeling capacity.

In conclusion, I would like to point out something quoted recently by the French cosmonaut Jean–Lou Chrétien: "Yes, the earth's core is enormous but, on its surface, life hangs on by a thread".

Thank you for your attention.

GLOBAL WARMING

Impact on oceans and fisheries

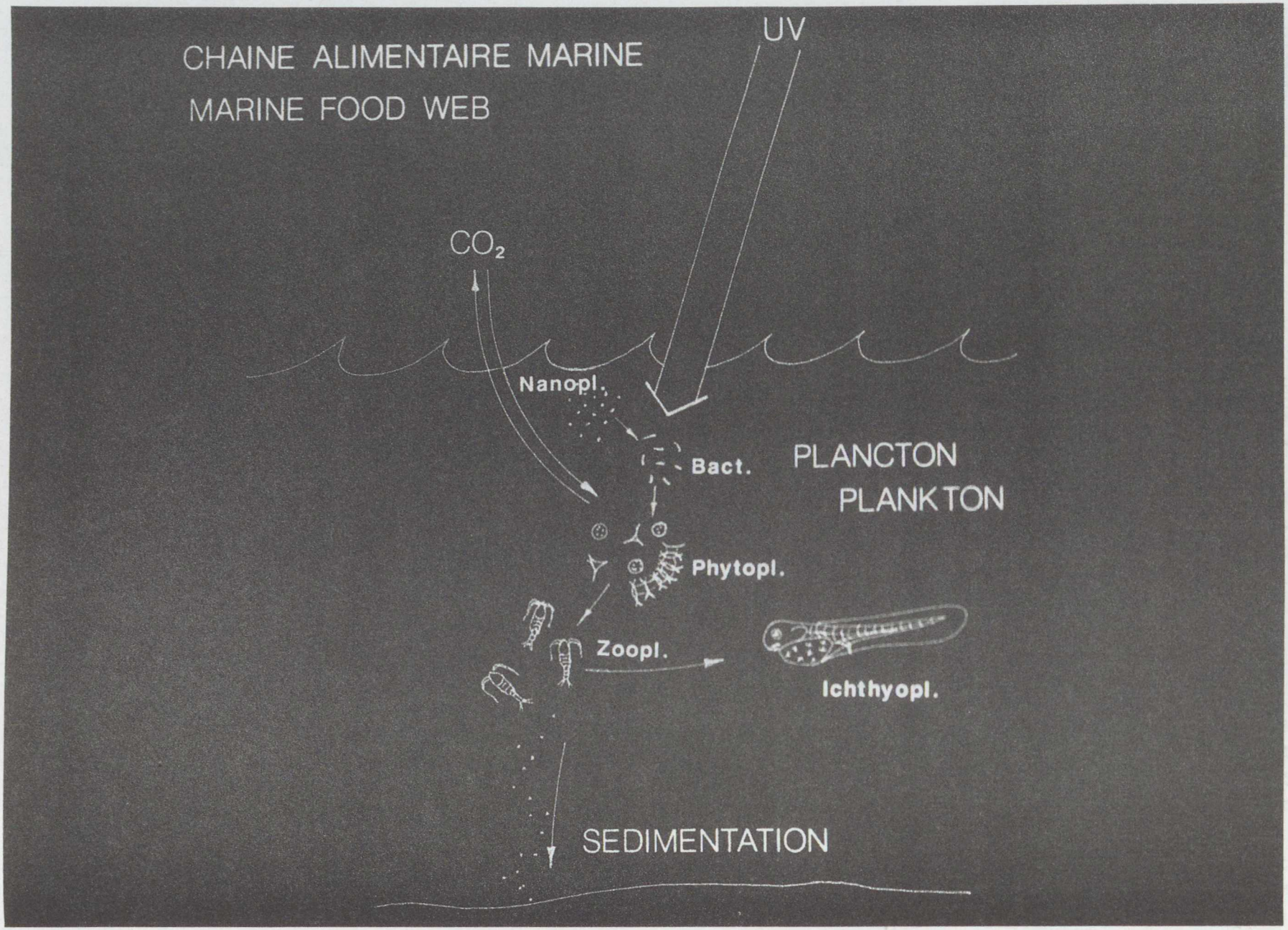
Summary of presentation

1. Hypotheses about climate and oceans
2. Impacts on Canada's oceans and inland waters
3. Impacts on Canadian fisheries
4. The importance of cooperative research
5. Highlights
6. What should we do?

1. Hypothesis about climate and oceans

- Climate hypothesis assumes a doubling of atmospheric CO_2 next 100 years.
- Oceans are important in the climate system, both as vast reservoirs to store heat and as sink for CO_2:
  - they cover 71% of Earth's surface;
  - they have an average depth of 3.5 km.
- Simulation of climate change is limited by poor knowledge of the oceans.
- Oceanic transport of heat poleward from the tropics is not well quantified.

- Warmer global climate may result in:
  - temperature increase in northern latitudes 3 times more than in tropical areas;
  - warmer seas and lakes;
  - raise of sea level by 20 cm to 1.5 m, during next 50 to 100 years, due to:
    - melt of glaciers;
    - thermal expansion of oceans.
  - northward retreat of winter sea ice;
  - fresher sea water;
  - less absorption of CO_2 by oceans;
  - more frequent storms.
- In the Pacific, measurements show, since 1960:
  - raise of sea level by 10 cm;
  - warming of 1.8°C of sea surface temperature;
  - accelerating trends;
  - unsure about causes of these changes.
- Depleted ozone layer may lead to:
  - more UV;
  - less photosynthesis by phytoplankton;
  - less CO_2 absorbed.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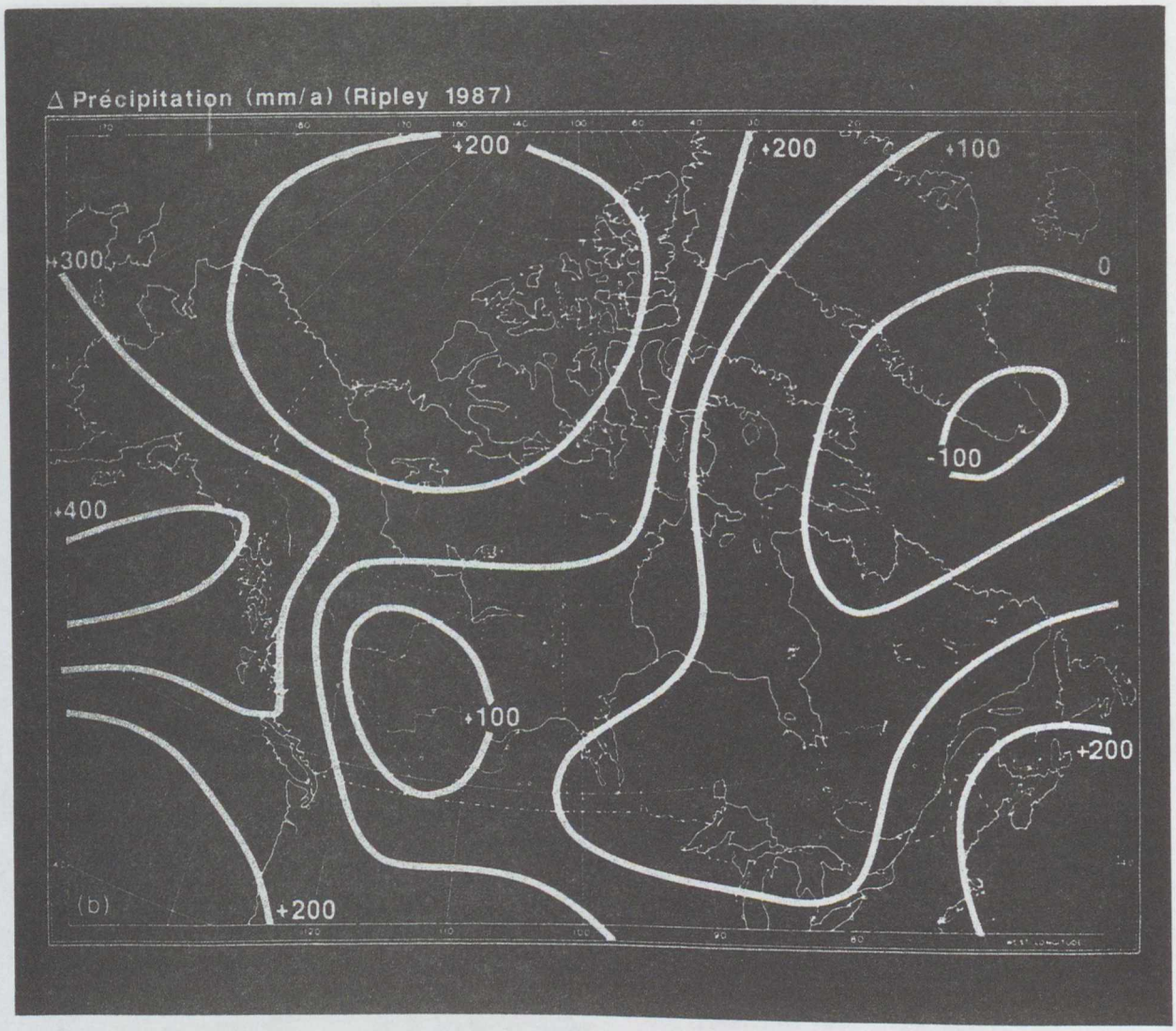
SEDIMENTATION

2. Impact on Canada's oceans and inland waters

- new stresses on the coastal environment and its users;
- sea level raise and more frequent storms may increase destruction of coastal areas;
- less sea ice;
  - impact on many polar species;
  - worse in the Arctic;
  - may increase habitat for warmer water species;
  - fishing harbours not icebound as long.
- melting of glaciers: more icebergs, a threat to navigation and offshore oil production;
- dryer summers and droughts except in the Arctic and the south-east;
- increased winter precipitation in the west.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3. Impact on Canadian fisheries

- climate change will have a major impact on our fisheries;
- general northward displacement of many commercial species.

- For example:
  - certain species could become more abundant with changed ranges, such as squid, mackerel in the Atlantic, hake and albacore tuna in the Pacific;
  - decreased primary production in Atlantic Canada could affect the abundance of commercial stocks such as cod;
  - coastal salt marshes contributing to food web of marine species could be modified through flooding.
- Changes in wind patterns:
  - lower productivity in coastal areas;
  - potential more damage to infrastructures;
  - more interference with, and risk for fishing activity.
- Aquaculture could benefit from warmer water and less ice: faster growth of fish and, on the Atlantic Coast, more sites.

- Increased water column stratification could lead to more toxic algae.

- Warming of sea water by 0.5°C to 2.5°C in the 1940–50's in the Gulf of Maine resulted in:

  - a few species moving north;

  - no obvious major changes in the faunal composition.

In freshwater

- more than 30 new species may invade the warmer Great Lakes from the south.

- under worst scenario, Lake Manitoba may dry out and Lake Winnipeg shrink considerably.

4. The importance of cooperative research

- We need to better predict the impact of climate change on marine fisheries.
- Improved understanding of ocean processes and of fish adaptability is required.
- Knowledge is inadequate to predict reactions of most marine populations to change.
- Learn more about the variability of the future climate.
- Increased frequency of extreme conditions could be more harmful to fisheries than gradual change.
- Present ability to predict ocean climate changes is both limited and primitive.
- Arctic Ocean may be a major element in determining climate change, but little research is currently done there.
- Canada should do more climate research related to oceans at the national and international levels (WOCE, JGOFS).
- Considerable spin–off for Canada possible.
- Strong cooperation with universities and NSERC for JGOFS and WOCE.

5. Highlights

- Global warming is likely to lead to:
  - warmer waters
  - higher sea level
  - changes in current and salinity patterns

It is therefore likely to result in significant impacts on Canadian fisheries.

- Assessment of these impacts requires better scientific understanding and data.
  - Present projections of global warming cannot be accepted with confidence.
  - Improved Canadian capabilities for large scale ocean circulation modelling is required.
  - Worldwide concern over global warming and its impacts offer a market opportunity.
  - DFO is active in climate change research initiatives and is developing a Canadian ocean climate program.

6. What should we do?

- Increase research on:
  - how warming oceans influence climate (JGOFS, WOCE);
  - effects of changing environment on commercial fish species;
  - consequences of higher sea levels and more frequent storms on security of coastal areas;
  - role of Arctic seas in relation to climate warming;
  - better modelling capacity.

The Chairman: Thank you, Dr. Boulva.

Mr. Fulton: I am particularly interested in the capacity of the oceans as a sink. From recently published articles it seems that the oceans are not as great a carbon dioxide sink as had previously been supposed, and that the northern oceans will likely be a greater carbon dioxide sink than the southern hemisphere.

Studies already done show that when you get the combined effect.... I think it is reasonably clear from the scientific evidence that the hole in the ozone is creating greater planktonic die-off near the Antarctic, but what is the likely impact of a growing ozone hole and increasing concentrations of carbon dioxide in our northern hemispheric oceans, as opposed to the southern ones?

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Dr. Boulva: A number of processes are involved. I did mention that as sea water becomes warmer with global climates on the surface, it will be able to retain less carbon dioxide. However, as the concentration of carbon dioxide in the atmosphere increases, there will be more in the water. That is one factor.

Another factor is that, as mentioned, the capacity of phytoplankton to transform carbon dioxide into carbon hydrates and oxygen will be limited by the increasing ultaviolet b-rays hitting the surface of the oceans. A lot of research is presently under way in many countries to try to quantify this effect.

Concerning the Antarctic, for example, which is an important area for hydroplankton production, a lot of this production occurs during the Antarctic spring when the ozone hole is at one of its largest sizes. So the impact on plankton is felt to be an important one.

As far as the role of uptake of CO_2 by the oceans is concerned, it is estimated that about half the CO_2 produced by human activity since the industrial revolution has been absorbed by the oceans.

Mr. Stevenson: I appreciate your comments.

This morning we asked one of the scientists, Dr. Schneider, about the absence of any biological feedback in the prediction models used for temperatures, rainfall and so on, in predicting what will happen with increasing global warming. From that sort of uncertainty, we must try to predict what will happen in oceans, biologically and chemically. That must certainly add considerably more uncertainty. With your comments on CO_2 sinks, whether they relate to photosynthesis or to chemical reaction and some sort of storage in the ocean, what range of error are we looking at in some of the issues you are talking about here? What confidence do you have that certain levels of CO_2 storage will occur at various stages as these changes occur?

Dr. Boulva: Current information is very crude. This is why international programs have been started, such as JGOFS, the Joint Global Ocean Flux Study, which began last year and will specifically try to measure the actual uptake of carbon dioxide by the ocean in various

parts of the world, be it phytoplankton or deep water convection; that is, the CO_2 being taken and sinking into the deep ocean, then remaining there for many centuries.

So there is presently little information on this subject. The JGOFS program will last 10 years and there will hopefully be more precise answers to this type of question in the years to come.

Mr. Fernand Robichaud (Beauséjour): You mentioned that the Fisheries and Oceans Department was currently studying the climate changes and that the capacity for prediction models needs to be improved. To that effect more research is needed than what we have now.

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What is, according to you, the amount of research that we should be doing in order to meet this situation? Twice as much, three times or ten times?

Mr. Boulva: Let me first make it clear that the research isn't done only by Fisheries and Oceans, but jointly with the Atmospheric Environment Service, with meteorologists and with climatologists, as there is a very strong interaction between the oceans and the atmosphere.

Taking this into account, our department supplied figures indicating that with twice as many resources, we could considerably contribute to finding answers to the current issues.

Mr. Robichaud: The other departments should do likewise.

Mr. Boulva: Yes, this matter will be brought up in the discussions on the Green Plan and the environmental agenda of the Canadian government.

Mr. Foster: Dr. Boulva, you mentioned in your presentation the impact on the lakes in Manitoba, that some of them might dry up and so on. I have heard reports that the Great Lakes might lose as much as one metre from shore levels. Some of the Great Lakes, such as Superior, are quite deep, while others, such as Erie, are much more shallow.

I am wondering what your estimates are of the loss in depth of the Great Lakes. What are the implications of that for the fishery, for instance, and for municipal water systems, for shipping, transportation and so on?

Dr. Boulva: In answer to this, again the information is so crude that you have varying opinion. I have read reports to the effect of what you are mentioning. I read another one that suggests the outflow from the Great Lakes may increase by 8%.

You have to calculate, first of all, how much more rain will fall in the area due to the changing climate pattern. You have to take into consideration the increased evaporation that will result from warmer temperatures. Given the excessive imprecision in the models, it is very difficult to be precise.

The other factor in this, of course, is that the conditions will be varying in different parts of the country. You will have droughts in one area and you will have a lot more water on the west coast, for instance. The southeast may remain a bit unchanged or a little wetter.

We really need better models, as was mentioned today by Dr. Schneider, to be able to come up with more definite answers to these worries.

Mr. Laporte (Moose Jaw—Lake Centre): You mentioned that the studies are very incomplete, that the information is very vague, that we need a lot more research. What areas need to be focused on? Where should we be putting our emphasis with respect to this area?

You have discussed a huge area. Where would you put the emphasis on with respect to research and the need for more research?

Dr. Boulva: As I mentioned, a number of international programs have been started. I think a good start for Canada would just be to have a very active role in supporting these programs on the global oceanic environment. With WOCE, World Ocean Circulation Experiment, and JGOFS, I think we will learn more.

If we are not even as active as we should be in those programs, certainly we are not going to make much headway. By participating in these programs we will benefit from the overall information collected. We will be able to orient such programs to make sure they cover questions of interest to our country.

.2000

Mr. Fulton: My question is actually quite short. You did not actually touch on it, but it is something that has been raised from time to time. I am particularly interested in the changing sea state, which is perhaps not entirely related to global warming but related to a combination of effects. Certainly the architectural and marine engineering studies that have been done have brought about a change even in the design of some vessels that regularly transit the Atlantic.

Can you give us any kind of information on what is happening with the sea state change? I was surprised about the point you made that the Pacific Ocean has risen four inches. I can feel it where I live. I live only a couple of feet above sea level. But what is happening to the sea state?

Dr. Boulva: The current thinking is there will be changes to the wind patterns, and particularly you will possibly be getting more frequent storms of the same intensity or even possibly more violent storms. But this is very vague at this time.

The idea behind this is that as the oceans accumulate more energy, and possibly climate fronts become more marked between Arctic fronts and warm fronts, the storms will be more violent. Some people have said that the example of what happened in Europe in February of this year might become the norm rather than the exception. So the sea state for vessels will mean more risk for transitting vessels across the oceans, and better weather information on storms will certainly be a requirement.

Mr. Caccia: Would you tell us briefly why Canada has not yet ratified the Law of the Sea? Sixty nations are needed. Forty-three have signed. What is the impediment for Canada?

Dr. Boulva: I am afraid that is not in my competence. It is outside the science area.

Mr. Stevenson: We hear from time to time of the temperature changes related to El Nino, the ocean current off the west coast of North America, and the impact that can have on various fish species. Also, it is implied that at times it has significant impact on some weather patterns. To what extent do you believe these are true? The temperature changes of the ocean that you are discussing here today, are they considerably greater than what we see in fluctuations in El Nino and its impact on weather?

Dr. Boulva: The average increase in temperature that I mentioned for the Pacific Ocean takes into account the warmer temperature due to El Nino, which is a warm water current. There is still some debate as to the source of this warm water current. It comes from the very deep water of the Pacific Ocean. Whether it is actually caused by geothermal warming at the bottom of the ocean or actually due to atmospheric warming, or possibly a combination of both, is not resolved at this time.

The Chairman: Dr. Boulva, the number of questions that you were asked is a testimony to the interest raised by your presentation.

We would now like to ask Mr. Jag Maini to give his presentation.

Mr. Jag Maini (Assistant Deputy Minister for Policy, Forestry Canada): Mr. Chairman, I would like to thank you for your invitation to appear before you and congratulate you for having organized such an important forum.

In my presentation this evening, I would like to cover five points. I will give a brief background on this climate change regarding forestry, an overview on the impact of this climate change on forests, a description of Canada's forests, the impact of global warming on trees and forests, response strategies to global warming one might consider and finally, to talk about forests as a part of the solution.

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As background, if we review environmental issues of the last three decades, we see a gradual increase in the size and scale and scope and complexity of issues. In the 1960s we talked about local issues, in the 1970s about regional issues, in the 1970s and 1980s about national issues, and in the 1980s we started talking about global issues—global-scale deforestation, oceans, global warming, etc. This gives you a little perspective on how the global-warming issue is situated in overall environmental issues.

Three things have happened: increase in scale, and complexity of issues—these issues are no longer discussed only in scientific forums—and thirdly, the general public is getting very involved in the resolution of these issues.

The whole issue of global climate change can be viewed within the context of global change. Within the global framework we are looking at deforestation, the degradation of the quality of water, oceans, soil erosion, and also the increasing pollution load in the atmosphere.

These issues are all interconnected. From a forestry perspective, for example, if you plant trees you are also helping with watershed management, you are preventing soil erosion, and you also are helping with local and regional changes in climate, etc.

I will give you a very brief review of those global warming issues, which are important from the forestry point of view. There is a general feeling in the scientific community that the temperature could change anywhere from 1.5 to 4.5 degrees Centigrade. These are average global temperatures, and this could happen as early as 2015 if we continue increasing the use of energy, or up to the year 2075 if we are very careful and start taking immediate actions to dampen our energy consumption.

The point we need to remind ourselves of from a Canadian point of view is that these are average global temperatures we are talking about, and the anticipated increase in temperature is latitudinally uneven. In the tropics it will increase less, and towards the Pole the change of temeprature is expected to be more; we are in the middle latitudes where our boreal forests are located.

The second important thing from the forestry point of view is soil moisture. There is some uncertainty about moisture conditions, whether it will be available during the growing season or not. From a Canadian point of view a number of people will argue if it warms, so much the better because it is too cold here anyway and the trees will grow faster. Trees can grow faster only if there is adequate moisture.

Just to give you some comparisons. During the past 10,000 years there has been an increase of one degree Centigrade in temperature; during the past 100 years, since the pollution, the greenhouse gases have increased in the atmosphere, there has been a change of 0.6 degrees. These figures are well discussed in the literature.

Climate change is not a new phenomenon, it has happened in the past. Canadians are familiar with the last glaciation which happened about 10,000 years ago. The climate has fluctuated back and forth over thousands and thousands of years.

From a biological point of view the climate change we are anticipating now is significant from the point of view that the rate at which the temperature changes or is expected to change is a lot greater than anything the trees have experienced in the past. During the past 10,000 years when the glaciers started melting, the vegetation, the trees, etc., followed the retreat of glaciers. For over 10,000 years this migration has been taking place in Canada. But the rate at which the temperature is going to be changing is lost a lot faster than what we would call the evolutionary experience of trees.

Carbon dioxide constitutes about 50% of the total greenhouse gases, and other greenhouse gases constitute about 50%. The northern hemisphere contributes about 75% of the total carbon dioxide, and the southern hemisphere, the developing countries, contribute about 25%. The fossil fuels contribute about 80% of the greenhouse gases, and over history deforestation at the global scale has contributed about 20% of the greenhouse gases.

The forests are long-lived ecosystems that are subjected to various kinds of disturbances. Some of them are natural—like fires, storms, insects, and diseases—and others are forest-sector activities—the way we harvest our forests, the way we manage our forests or fail to manage our forests. The forests are also exposed to a number of other stresses, like airborne pollutants, acid rain, etc., which you are quite familiar with. The reason I mention this is that whereas forests have been exposed to natural disturbances and also man-made disturbances, this new issue we are going to be facing is of a magnitude that has not been experienced by the forest landscape.

This is a quick review of global forests in Canada, this green part. We constitute about 10% of the world's forest resources, and other major forest lands are in Africa, the U.S.S.R., South America, and the United States. The important thing to recognize is here we are talking only as a country, and these other big chunks are continents. Canada does have 10% of the world's forest resources.

Now I would like to focus more precisely on the issues we are likely to be facing in Canada. Fifty percent of Canada is covered by forests, and climate change is likely to have some profound implications to the way we practise forestry or what happens to the forest landscape.

First, to recapitulate, the global forest resource was about 6 billion hectares about 8,000 years ago, and it has been reduced to about 4 billion hectares. So that 20% increase in carbon dioxide due to global deforestation is a one-third loss of forests on the global scale.

Now, coming to Canada, some of the studies we have done in the country indicate—and these are very simple first approximations—that for every one degree change in temperature the forest belts are likely to move about 100 kilometres northward. So where you have forests of a certain kind—for example, the Aspen belt in Saskatchewan—when the temperature warms, the likely shift for a one-degree increase in temperature is roughly about 100 kilometres northward. Not only will these forest belts shift northwards, in the mountainous regions they will move upwards. For example, in British Columbia, where we have treeless alpine areas, the forests are likely to migrate when it warms up.

I will very quickly touch on various aspects of trees and forests that will be affected by global warming. The growth of trees that is likely to take place is affected. For example, in those areas where temperature is a limiting factor towards the northern edges, it is likely to

increase in its growth, provided moisture is not a limiting factor. Some very crude estimates that have been done would suggest that in some areas we would experience increasing growth, and in other areas decreasing growth. The overall balance is not likely to change, except the belso shift.

My own judgment is that reproductive processes are one of the first processes that, under stress, are likely to be affected, and in some cases adequate seeding may not take place. But we also know that in some species when there is a major stress—sometimes we deliberately stress the trees—there is a very profuse formation of seeds.

.2015

Some scientists in Canada believe that some of the ground vegetation is likely to increase under the warm temperature regimes. There is also concern that some of the species we are planting may not be able to survive altered temperature regimes. For example, if one accepts the worst scenario, then by the year 2030 or 2040 there may be a considerably different climate than there is today. We select our genetic material by its suitability to today's climate. By the year 2030 the trees will have reached only half their rotation age.

This is an interesting issue that we need to think about. These major shocks to biological systems often trigger some new evolutionary phenomena, and while some of the species are likely to disappear, some new types could be evolving.

Fire is an important area that we need to think about and worry about, because the fires are driven largely by climatic conditions, the humidity, the temperature, etc. If we look at some of the predictions of the warming tendency that we anticipate, then we could have some major problems in forest fires. Some of us have seen or read about the forest fires in Manitoba last year, and I am not saying they were triggered due to temperature warming, a global warming, but we did have an analogue of what could happen when the temperature increases.

This is a fire danger map of Canada. The red areas show a high danger for forest fires, and as you can see, the Okanagan Valley in British Columbia is a very high fire danger area. All these danger ratings are driven by climatic parameters, and if the temperature warms, one could anticipate that some of these tongues of high danger would extend much further north and all these isolines will shift further north.

After fire, insects and diseases, there is a possibility that some of the insects and diseases not found in Canada at present because of our cold climate, and which are found in the United States, are likely to extend further north. The warm temperatures are also likely to affect our forest harvesting operations. As you know, a lot of our harvesting is done during the winter when the ground is frozen, and if our winters are milder, we may have to adjust our harvesting technologies.

Hydrology is another very important factor that we need to think about. If you look at the map of Canada, practically all the major river systems in Canada have watersheds that

are forested. If there is a change in species composition or forest covers, then the quality and quantity of water, and even the periodicity of water flows could be severely altered. Similarly, the wildlife habitat is going to be affected.

These are maps that show the vegetation zones of the world on a climatic basis, and I would like you to focus your attention on this part of the map. Here is the prairie region of Canada—Saskatchewan, Alberta, Manitoba—and under a doubled carbon dioxide scenario you can see how the prairie climate will move further north. I want to emphasize that I am not saying the Prairies will move to the Arctic Ocean per se in the next 35 or 40 years if the doubling takes place; the prairie climate will extend that far north. Eventually, over hundreds of year, the vegetation shifts will take place.

Why are we concerned about this climate as far as forestry is concerned? We are concerned from both economic and environmental aspects: a large employment base, regional development, 350 communities, tourism at $27 billion, trade, the biggest industry in Canada, 15% of the transport investments, revenue, etc. Forestry is economically a very important sector in our economy.

.2020

Equally important is the environmental role of Canada's forests. As I indicated, 50% of Canada is covered by forest. It is 10% of the world's forest land, so we have a responsibility as Canadians to manage it from a national as well as from a global point of view. Forests are the heart and lungs of the world. Forested watersheds—I talked about it; climate and air quality regulations play an important ecological role and they are essential to wild life habitat, national parks, fishing streams and tourism.

When you put together both the environmental as well as the economic aspects of forests, you can see how crucial it is for us to maintain this landscape in a healthy state and to develop some programs to overcome the impact of the changes that are anticipated.

The response strategies revolve around two or three things—reduce the emission of greenhouse gases, expand carbon reservoir. Forests are a very important part of the global carbon reservoir. Some 86% of the world's land–based carbon is in forests; 76% of the soil carbon is in forest soils. One of the major areas we should be focusing on is expanding this carbon reservoir, both in Canada and in other parts of the world, and we should develop adaptive strategies like different harvesting techniques to cope with winter harvesting.

I think that taking forests as a part of the solution there are 10 things we can do, and they are not 10 commandments. I wrote them; they did not come down.

First and foremost is enhance, create and expand carbon reservoirs, increase our reforestation programs. I think that is very crucial. This is one of those things that has no regret policy option. When you plant trees you are protecting watersheds, wild life habitat and overall landscape rehabilitation.

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First and foremost is enhance, create and expand carbon reservoirs, increase our reforestation programs. I think that is very crucial. This is one of those things that has no regret policy option. When you plant trees you are protecting watersheds, wild life habitat and overall landscape rehabilitation.

We need to protect the forests from pollutants. It is not just going and planting trees like good boy scouts, but it is an expensive business and we must take all of the steps that are necessary to protect them from things like acid rain.

We must promote the use of wood as an environmentally friendly product. Wood, for example, God gives us with the sunshine, and it is better to use a wooden stud than an aluminum stud which involves a lot of energy and environmentally stressing processes.

We should encourage recycling and develop energy efficient technologies. I am pleased to note that when the energy crunch hit Canada, the pulp and paper industry embarked on a major program of energy conservation, and during the last 10 or 15 years, if my recollection is correct, they have reduced the use of energy by 35% for every tonne of pulp that they produce.

I think we need to protect forested watersheds because not only are they important from the trees' point of view but our whole economic well-being and our personal well-being are driven by the water supply. This is an important issue, particularly in the prairie provinces.

In comparison with fossil fuels, we could be encouraging the use of forest biomass. In the overall equation this is less environmentally stressing than use of fossil fuels. It is very important to keep our future options open to protect species diversity. We must strengthen work on bio-monitoring.

In Canada we have established an early warning system for acid rain. I think we need to expand that network in forests to do a complete, more thorough bio-monitoring, seeing how the climate changes are impacting on our biological life as well as trees.

We need to strengthen our research to predict the response of our forest ecosystems to a different temperature regime. At the present moment we have some preliminary information, the very first crude approximation as to what is likely to happen if the climate changes and global warming take place, but again this is strictly a very, very first crude approximation. I think we need to strengthen that part of our activity to develop more intelligent response strategies.

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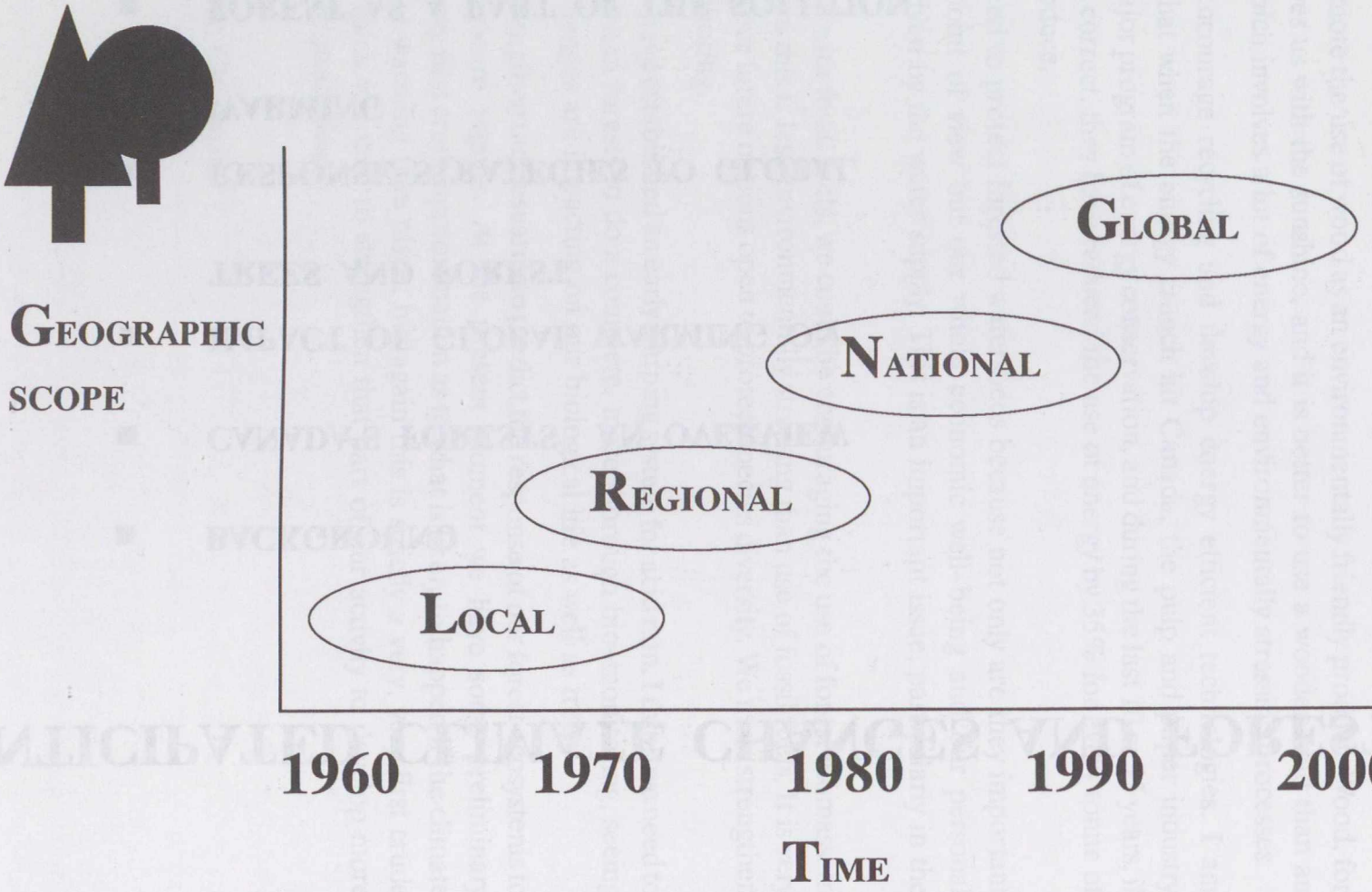
Thank you, Mr. Chairman.

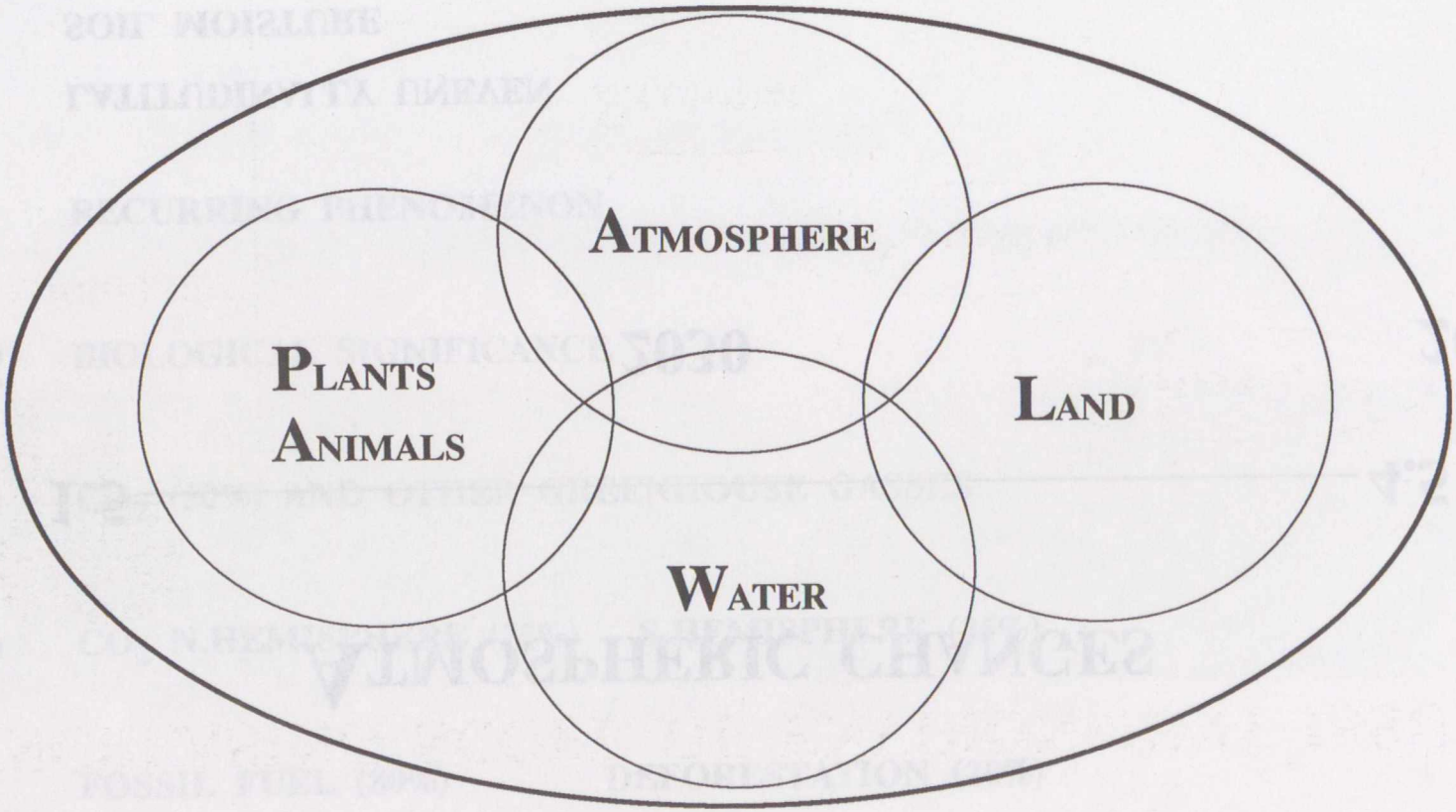
ANTICIPATED CLIMATE CHANGES AND FORESTS

- BACKGROUND
- CANADA'S FORESTS : AN OVERVIEW
- IMPACT OF GLOBAL WARMING ON TREES AND FOREST
- RESPONSE STRATEGIES TO GLOBAL WARMING
- FOREST AS A PART OF THE SOLUTION

Increasing scope of environment issues



GLOBAL CHANGE



ATMOSPHERIC CHANGES

1.5 ——————————————————— **4.5**

2015 **2030** **2075**

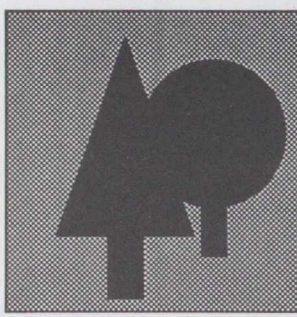
- **LATITUDINALLY UNEVEN**
- **SOIL MOISTURE**
- **TRENDS : PAST 10,000 YEARS 1^{O} C**

  PAST 100 YEARS 0.6^{O} C

ATMOSPHERIC CHANGES

- **RECURRING PHENOMENON**
- **BIOLOGICAL SIGNIFICANCE**
- **CO_2 (50%) AND OTHER GREENHOUSE GASSES**
- **CO_2 N.HEMISPHERE (75%) S.HEMISPHERE (25%)**

FOSSIL FUEL (80%) DEFORESTATION (20%)



FOREST ECOSYSTEMS

FOREST : LONG LIVED ECOSYSTEMS SUBJECTED TO DISTURBANCES

- **NATURAL**
- **FOREST SECTOR ACTIVITIES**
- **OTHER INDUSTRIAL AND CONSUMPTIVE ACTIVITIES**

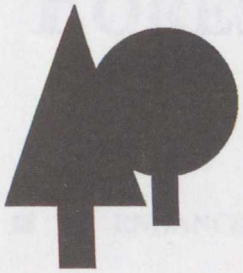
MAINI – FORESTRY CANADA 1989

ECONOMIC IMPORTANCE OF THE FOREST SECTOR

- **TRADE** – 38B SHIPMENTS
  – 21B EXPORTS (1987)
- **TRANSPORT** – 15% OF TOTAL FREIGHT (1 IN 6)
- **INVESTMENT** – 20% OF TOTAL MANUFACTURING
  – 5.5B ANNUALLY
- **REVENUE** – FEDERAL INCOME TAXES :
  $1.7B/ANNUM

ECONOMIC IMPORTANCE OF THE FOREST SECTOR

- **EMPLOYMENT** – **270,000 DIRECT**
  – **500,000 INDIRECT**
- **REGIONAL DEVELOPMENT** – **350 COMMUNITIES**
- **NATIVES' SELF RELIANCE** – **$**
- **TOURISM AND RECREATION** – **$37B**



ENVIRONMENTAL IMPORTANCE OF THE FOREST SECTOR

- 50% OF CANADA'S LAND BASE
- 10% OF WORLD'S FOREST LAND
- HEART AND LUNGS OF THE WORLD
  - –FORESTED WATERSHEDS
  - –CLIMATE AND AIR QUALITY REGULATION
- ESSENTIAL TO :
  - –WILDLIFE HABITAT
  - –FISHING STREAMS
  - –NATIONAL PARKS
  - –TOURISM

RESPONSE STRATEGIES

- **REDUCE THE EMISSION OF GREEHOUSE GASSES**
- **EXPAND CARBON RESERVOIR (FOREST)**
- **DEVELOP ADAPTIVE STRATEGIES**

FORESTS AS A PART OF THE SOLUTION

- ENHANCE (CREATE AND EXPAND) CARBON RESERVOIRS
- PROTECT FORESTS FROM POLLUTANTS
- USE ENVIRONMENTALLY FRIENDLY WOOD
- ENCOURAGE RECYCLING
- DEVELOP ENERGY EFFICIENT TECHNOLOGIES
- PROTECT FORESTED WATERSHEDS
- ENCOURAGE FOREST BIOMASS
- PROTECT SPECIES DIVERSITY
- STRENGTHEN WORK ON BIO-MONITORING
- STRENGTHEN RESEARCH TO PREDICT RESPONSE

The Chairman: Thank you very much, Dr. Maini.

Mr. Caccia: Since this exercise is about global climate change and Dr. Maini made a reference to the carbon role on the part of the forest, could he give us an overview of the forest ecosystem carbon role in the totality of the carbon imbalance that at present exists according to the estimates that have been made so far; in other words, put the forest in the broader perspective?

Dr. Maini: As I indicated, 20% of the carbon dioxide load in the atmosphere is attributed to global deforestation over the last 8,000 years, if I can stretch that far back. That is, about 8,000 years ago the total forest area in the world was 6 billion hectares, and now it is 4 billion hectares.

In the world, the total annual emission is in the order of 5 billion tonnes of carbon. About 2.9 billion tonnes is removed every year, and there is an increased burden of something in the order of 2.9 billion tonnes of carbon in the atmosphere.

If you plant 1 billion trees, they would take up about 13 million tonnes of carbon annually. Once you plant them, every year you are removing 13 million tonnes. Estimates have been made in the United States that suggest we need to plant something in the order of 465 million hectares of forest around the world.

That gives you some dimensions of the magnitude of the problem we are facing as far as the role of reforestation in this whole global warming question is concerned.

Mr. Caccia: Would that last figure bring back the 4 billion hectares to 6 billion hectares?

Dr. Maini: No, not quite.

Mr. Stevenson: You mention the significance of the carbon sink in forests. Would you compare for me the relative strength as a carbon sink of a coniferous forest versus a deciduous forest, in photosynthetic efficiency on a per-acre basis, thinking of course about the length of season a coniferous forest is green relative to a deciduous forest? I suppose another factor that has to go in there is the risk of forest fires and the likelihood of one forest being in place for a little longer than another and so on. How does that all sort out in significance in getting rid of CO_2?

Dr. Maini: If you will permit me, I will try to turn your question around a bit. I do not think the absolute rates of photosynthesis of conifers versus hardwoods are important. They are important from the point of view that we know how much carbon is being fixed, but more important is the net assimilation in trees. For example, in coniferous forest, as I indicated, 83% of the land-based carbon is in trees and 73% of the soil-based carbon is in forest soils. With our climate in Canada, for example, where it is cool and moist, a lot of material that falls on the ground gets accumulated in the soils and it forms a very important carbon reservoir.

In hardwood forests the decomposition rates are higher. I could not give you the exact relative net accumulation of carbon, but I think we could calculate it if you are interested, and provide you with this information.

The role of arboreal forests is becoming more and more important. Recent research indicates that for a long time scientists could not account for about 25% of the carbon dioxide. Very recently they are suggesting that it is bound in there, in the boreal forests where we are located. I think it is very important for us to look after it.

I am not evading your question. It is just that we need to look at the net assimilation rather than rates of photosynthesis.

Mr. Foster: I am interested to know what your view is on policy with regard to our forestry industry. Is it simply a case of planting more trees to maintain a better climate, or at some stage will it be necessary to reduce the amount of trees we cut down to produce *The Toronto Star* and *The Ottawa Citizen* and other newspapers and to construct homes out of wood and so on? What are the policy options here?

Dr. Maini: I would approach this in two ways. One, in practically every province in the country now they are insisting that industries harvesting the forest should replant. The trend in the country is along those lines.

For example, in British Columbia and Quebec, statements by the governments have been that they will clean up all the backlog by the year 2000. That is their target. So I would say that under the present reforesting regime, we would be moving towards catching up with the backlog. But we will not clean up by the year 2000.

Two, the industry is allowed to cut forests based on some rather careful calculations called "annual allowable cut". The principle here is that we just harvest the interest and not the principal—although we have not always followed that in the past. If the climate regime changes, and through our monitoring systems measuring the growth rates of trees we see a decline or an increase in forest growth, we can adjust the cutting regimes accordingly.

I think it is possible, technologically it is possible, to cut less wood and to manage them better through low waste, better utilization, more recycling. For example, we understand that you can recycle paper seven times. That creates an additional resource and also creates a temporary, in-transition carbon reservoir.

Mr. Fulton: Dr. Maini, in last month's publication of *Science* they were actually evaluating the oceans. While doing their calculations they discovered that it is quite likely that the temperate zone forests, those in North America, Europe, Asia, and the Soviet Union, are probably the greatest carbon sinks.

Many people have become very much fixated on the loss of tropical rain forests. As I said earlier today, we are losing these to fire and to harvesting at a rate of one acre per second. We are running very close to that here in Canada. We are losing an acre every four seconds, which is a very substantial loss to forest and to harvesting.

Add that one acre every four seconds to the billions in losses that CFS and others have done in terms of calculations of acid precipitation loss, principally in Quebec, Ontario, and some parts of the Maritimes. Add to that the prairie acreages, which many scientists believe are probably one of the most altered ecological systems on the face of the earth. The Prairies were not simply grasses that were simply turned over with oxen and plows.

.2035

If you add all of those together, and this is where my question comes in, and using your figure, the suggestion that we had 6 billion hectares worldwide of forest cover, we are now around 4 billion hectares. It has been suggested that we need to replant at least 465 million hectares of forest and Canada is presently about 10% of the world's forest. Is it correct for those of here this evening and those watching to assume that Canada should really be targeting the replanting of 46 million or more hectares of forest?

Dr. Maini: I think you partially answered the question yourself when you said there was a study in *Science* about a month ago that the boreal forest belt is very crucial. Charity begins at home and before we start asking people in the tropical countries to do more reforestation, tree planting, etc., I think it is important for us to reforest those lands that have not been reforested and, in view of the critical importance in the carbon cycle, to enhance the forest land in Canada to enrich our carbon reservoir, as both a national policy and part of our responsibility as a global community.

Mr. Fulton: I am wondering, though, if I am being fair in asking that 46 million is roughly what we should be looking to reforest.

Dr. Maini: I am not sure that the 46 million is the correct figure, but it is substantial.

Mr. Worthy (Cariboo – Chilcotin): I am going to be continuing on with what several of us have really been asking questions about, skirting the issue. What is going to be the difference between letting our forests grow unharvested and responsible harvesting and replanting or encouraging the natural region where it does occur and planting where it is necessary? Can we in fact achieve a balance? Can we end up ahead of the game with responsible management or will we be in fact faced with environmental losses, losing ground to CO_2 because of the use of the forest?

Dr. Maini: The forest state is never constant, because of harvesting for economic reasons, fires, insects and diseases. The landscape is a mosaic that keeps changing all the time. Ideally one would want to have human harvesting duplicating nature's interventions in some ways.

From that point of view, as long as we are following the annual allowable cut in Canada we can remove that part of forests for economic purposes, but through more careful management we can enhance what we call the middle-age stands, for example. By doing silviculture treatments, we can increase growth in those stands and increase indirectly the carbon reservoir.

Mr. Worthy: By thinning out the undergrowth, we add to the merchantable timber. Are we balancing the CO_2 cycle or are we in fact...? In other words, is that undergrowth capable of absorbing more CO_2 than the increased fibre we are creating in the trees?

Dr. Maini: I could not answer that question with precise knowledge, but my judgment would be that you are just shifting the biomass production from undergrowth to trees. That would be my instinct, but I do not know any data that will support it.

Mr. Robichaud: I would like first of all to make an observation. I wouldn't want to criticize your presentation, but I have seen only one bilingual slide in your presentation; "spruce" and *épinette*. Since the second one showed a forest fire, the words were not necessary.

.2040

Usually, I would have found it difficult to accept that someone representing a federal agency give us a presentation in one language only. If Mr. Boulva had made his presentation in the other language, this wouldn't have been acceptable. I feel I had to make this comment, Mr. Chairman.

You said in your presentation that we should intensify our research efforts. Do you agree with Mr. Boulva who says that we should double our present research effort?

Dr. Maini: Mr. Chairman, at the present moment our research in this whole area of climate, global warming and impact on forest is modest. At least a doubling would be an initial start. I would like to underline that because of a lot of uncertainty about how the climate changed will unfold, one would want to develop successive degrees of refinement and to increase research as the time progresses. For the immediate future, a doubling is not an unreasonable target.

Mr. Laporte: I would like to follow up on the question of my colleague who pointed out that, depending where in the world you put these forests, it may have more impact and more benefit. I am wondering in Canada itself if there are certain regions in the country that should be focusing on forests. Is it better to have forests in areas where there is industry, for example? Is it more beneficial to the environment? Does it matter where these forests are placed? Is there some area of the country where there should be a focus on reforestation?

Dr. Maini: From strictly an economic point of view, one would want to invest money in those areas where you get the best growth rates. These are on best sites in coastal bay British Columbia and in certain parts of the boreal forests in central and north–central Ontario and Quebec. When the money is being invested in Canada by provinces and industry, the preference is given to what we call high–quality sites.

Mr. Laporte: Why are those areas better?

Dr. Maini: It is because of the soils, moisture available and temperature available. In Canada our soils are very young. This land was glaciated 10,000 years ago and some of the

soils are just bare rocks. You have to drill a hole in rocks to plant a tree, and you do not want to do that.

Mr. Laporte: The source of CO_2 itself has no bearing on where the forests are located.

Dr. Maini: No. It is part of the global circulation pattern.

Mr. LeBlanc (Cape Breton Highlands—Canso): In your 10-point response strategy, you suggested that one aspect is to protect the forest diversity. I would like to ask you if this implies, in a reforestation plan, an emphasis on mixed culture as opposed to monoculture and whether it is important that we emphasize mixed culture or whether, as applied to current practice by industry in reforestation programs, it is not significant from the scale you talked about.

Dr. Maini: We need to look at this question from two points of view. One is diversity within a species and the second is diversity in mixed species. Canada has millions and millions of hectares of forest that are one species only, black spruce or poplars, etc., and there are mixed wood stands also. All the trees that are planted in Canada are not highly selected, as hybrid corn in agriculture. Seed is collected from local areas and replanted in the local area.

Because we are not as sophisticated as some Europeans, from a genetic diversity point of view, we collect local seed and plant it locally. As far as species diversity is concerned, there are some areas where the forests are less diverse after planting because we are planting commercially imported species. But in those plantations you also see wild plants of other species coming in. So in some areas we have to think through very carefully about reducing diversity in terms of species composition.

.2045

Mr. Foster: Mr. Chairman, I wonder if the charts Dr. Maini has could appear in the minutes of today's meeting. I found them very useful. They will not show up like that in the committee minutes. I think we should consider that, Mr. Chairman.

Mr. Brightwell (Perth—Wellington—Waterloo): Mr. Chairman, I think the charts will in fact be in the minutes, but obviously not in colour. I think the record will be there, so I think Dr. Foster's needs will be met just in our normal proceedings.

Mr. Fulton: Doctor, I would like to go back to the point you made earlier, the 8,000-year one, where there were 6 billion hectares of forested land globe-wide. There are now about 4 billion. Where are we now in terms of forest land base shrinkage in Canada? What have we gone from to get down to 472 million hectares?

Dr. Maini: Several years ago I did this calculation and I can provide you those figures. But roughly all agricultural land in Ontario, Quebec, and the maritime provinces is former forest land. I did calculate it; I have that figure. It was a good approximation, I think. I can give it to you.

Mr. Fulton: I have a quick supplementary to that, and it flowed from Mr. Laporte's question. Are there now some areas of land, or parts of farms, that are presently being used for agriculture or other uses, that would be ideally suited to forest cover to improve the degree of moisture in the soils on the farms and so on?

Dr. Maini: There are marginal lands. When our markets were very good, we expanded into some marginal lands with heavy inputs of irrigation and fertilizers to bring them into agricultural cultivation. I think there are some marginal lands that could go back to forest. In Europe, the European Economic Community is doing exactly that: they are planting poplars and eucalyptus on marginal lands.

The Chairman: We will now have the pleasure of hearing the cream, the only woman. Mrs. Wheaton, please.

Ms Elaine E. Wheaton (Lead Scientist, Climatology Section, Saskatchewan Research Council): Thank you, Mr. Chairman. Hello, everyone.

I would like to remind everyone that human activities have indeed changed the composition of the atmosphere. These are just some of the activities. Industrial activity and transportation activity indeed have caused changes in the composition of the earth's atmosphere. That is well documented. Those are facts.

Now, it may not be quite as well-known that the climate of regions such as the three prairie provinces has also changed over the past. There are two main characteristics we can learn from such trends of climate through the past. The first main characteristic is that during the period of instrumental record, from late in the 1800s, there has been a gradual trend in these instrumental measured records of mean annual temperature for the three prairie provinces. There has been a general warming trend since the late 1800s.

.2050

Now, there have been some changes in terms of this warming trend being broken by a cooling trend in the 1950s. So the thing to note here is that even regional climates certainly have changed through history, even the short history that we have for an instrumental record.

The second thing to notice is that the climate of, say, the late 1800s and early 1900s was different from the climate of the 1930s, and that climate was different from that of the 1950s. In other words, the mean temperature gradually shifts through time and with it so do the extremes of temperature.

On occasion there are abrupt transitions from one type of climate to another, and these transitions can occur in relatively short periods of time. So from the science of climatology and from historical measured data we know that climates change through time regardless of cause not only on a global basis but also on a regional basis.

There is also a good set of lessons to be derived from the same type of trends of the mean annual temperature over a long period of record for locations such as the western

Canadian boreal forest. There are two main things to note from a slide such as this. One of them is that indeed a statistically significant warming trend has been occurring for each of the forest zones depicted here.

The second thing to notice here is the significance of the sensitivity of the ecosystems to only slight differences in mean annual temperature. The mean annual temperature difference between the predominantly forest climatic zone and the forest–grassland transition zone ranges only from about one to two degrees Celsius. So in terms of an ecosystem, in terms of a plant vegetation regime, small changes in a climatic parameter such as temperature are indeed significant and can mean some changes in that ecosystem.

Coming down to an even smaller scale, the Saskatchewan Research Council operates a climate reference station designed to monitor climate over a long term. This helps us to depict what has happened in the late 1970s and early 1980s in terms of annual mean temperatures. Although what we see here is just part of a trend, we see a clear and dramatic upward trend, especially during the 1980s. As Dr. Schneider reminded you this morning, the 1980s have been the warmest decade on our instrumental record. This is true not only of a place like Saskatoon, which could have some urban warming, but it is also true of small locations, of villages outside of Saskatoon well beyond urban warming. It is true of other locations spread across the Prairies.

So there have been noticeable trends in the climate of different regions. This helps us to address the "so what?" question in terms of societal–climatic relationships and linkages. The climate–society relationship is very complex, and diagrams such as these help us to conceptualize some of the basic structure behind these linkages.

The first type tells us that climatic variations are indeed related to certain activities, such as agriculture for sure, and there is a certain impact. A more realistic model shows that for each society and each type of climate a specific type of interaction results which has a specific impact. Our knowledge of the nature of these connections in an early stage of understanding, and it is crucial to estimating the type of impacts and societal responses that might result from specific climatic trends and changes.

.2055

In terms of its impact on agriculture, we think climate, temperature and precipitation are very closely linked to what we can grow and how well that production results. It is also a gauge of food prices and farm income. That is another view of the interaction between climate and economic activities such as agriculture.

One of the first enhanced greenhouse effect/climatic change impact studies was initiated and supported by the International Institute for Applied Systems Analysis and the United Nations Environment Programme as part of the World Climate Impact Studies Program. This project took place during the years 1983 to 1987, and was quite extensive.

The Canadian case study team was not only multidisciplinary, it was multi–agency. Disciplines included agriculture, climatology and a look at the socio–economics involved.

Again, it was a co-operative effort, multidisciplinary and multi-agency. With such a complex issue—ranging from a physical structure through an economic and socio-economic structure—it is appropriate to work in a multidisciplinary milieu.

Saskatchewan was only one case study region for this IIASA-UNEP project. The project included other high-latitude countries such as Iceland, Finland, Russia and northern Japan. This slide also shows one of the methodologies adopted in terms of exploring possible future climates and their impacts and adaptive responses to climatic change. One of the possible future climates for Saskatchewan is that of South Dakota and Nebraska.

Why was Saskatchewan chosen? Indeed, this could be typical of other parts of the Prairies. The primary reason was a combination of two factors. Saskatchewan, as compared to Ontario, B.C. or Alberta, has a moderately large economy—about the fifth largest according to this data—but a large portion of that economy—over 70%—is weather sensitive becouse it is linked to agriculture, forestry and other weather-sensitive activities. That is the reason we concentrate on certain case study areas to test possible impacts and consequences and response strategies.

.2100

In terms of looking at a range of possible future climates it is quite suitable, and it has been done in other studies, to look at first answering the question what would happen if the 1930s recurred. How vulnerable is our current agricultural system to the climate, say, of the 1930s? Indeed, that is an appropriate question because that climate essentially did recur in the 1980s except for a higher temperature.

The type of future climate that is used for impact analyses is also the very powerful general circulation models that Dr. Schneider referred to this morning, and indeed it is wise to use a range of all types of these possible climates to assess the vulnerability of, say, an agricultural sector to a certain climatic change.

The next question for such a study is what would be the temperature of a future climate into the middle of the next century. This graph depicts the seasonal changes as compared to the current climate, and you can see the summer temperature would increase in the order of two to three degrees. The winter temperature would experience a greater increase in the order of six to eight degrees. This is for a location just into the boreal forest past Prince Albert in central northern Saskatchewan.

The information about precipitation is much less certain, but it is very useful to consider the possibilities that could result with different possible future climates in an enhanced greenhouse future. This is the type of increase or change in precipitation as expected above the normal types of precipitation on a monthly basis that is experienced for the same location.

Of course the appropriate question in terms of what effect this would have on agriculture in terms of extremes, in terms of drought, in terms of heatwaves, in terms of

length of growing season, in terms of the type of climatic resources that are available for agriculture, is embedded in the day-to-day type of climate one might expect for a future climate.

In terms of a future climate for interior western Canada, it is quite possible that the current temperature climate in terms of this green line, which is the existing, the measured day-to-day variation, the variation, or the ups and downs in this green line, could stay the same. In terms of an enhanced greenhouse climate it is quite possible that the day-to-day temperatures could start exceeding this red limit, which is the record, the highest temperatures recorded for those specific days. This green line could start exceeding them at a much greater frequency but still have the considerable variation so that we can still have cold spells, perhaps not quite as intense, perhaps not quite with as great frequency, but still have these extremes of day-to-day types of climate.

In terms of an overview approach to what can be done for an assessment of a framework of looking at climate impacts it is useful to say what tools, what methods we have available that we can use to assess the impacts. Some of the tools that are used right now are indications of what changes in drought indices might result, what changes in precipitation effectiveness, methods to estimate biomass productivity in an enhanced greenhouse climate and how that relates to land degradation, changes in the basic land structure that supports this biomass, how these relate to spring wheat yields or indeed any crop yields, and how that eventually translates to economic impacts. Of course, we could also and should also include policy impacts and the interactions in the same sort of model of a multidisciplinary approach to this very complex problem. We should ask whether we have these tools fine-tuned enough to help us look at the present situation in terms of biomass, plant type of response, crop response to our current climate.

.2105

One of the needs that came out of various projects I mentioned previously is an emphasis on the need to improve understanding of the relationship of climate with plant growth, with land degradation, with water resources, with pests and diseases. Our basic understanding and capability to simulate these processes certainly needs to be improved and is a crucial part of improved climatic-change impact assessment, an improved part of how we can estimate future consequences in terms of basic, ongoing agricultural activities.

No, this is not the 1930s. This is the dirty 1980s. We certainly did have a continuation of dust storms and very visible, obvious evidence of massive wind erosion on the Prairies during the 1980s. The question is whether we have the capability, the understanding, to simulate how these changes might be extrapolated into the future with a changing climate, and indeed we are just learning how to do that.

Why do we need to improve our knowledge of these basic linkages of climate and plant growth? One of the most obvious answers is to prepare ourselves better for these impacts, not only in the future but right now. These climatic impacts are occurring now.

The Japanese colleagues had some very illustrative examples of climate change impacts on Japan that are relevant to Canadian agriculture. For instance, they looked at temperature rise in terms of mitigation of winter severity and noted there could be an adverse impact in Japan in terms of promotion of insect outbreaks. Note they also categorized these effects into profitable ones and adverse ones, and certainly did include an examination of changes in the water regime that could lead to an acceleration of soil degradation.

Another project was also a multidisciplinary, multi-agency project with an emphasis on ecosystems ranging from the grasslands into the boreal forest. As Jag mentioned earlier, it is expected the climate suited to this grassland area in the southern Prairies could shift northward; this prairie climate could shift northward, and a large portion of the boreal forest may be more suited to a prairie type of climate.

So where do we go from here? We have to address that "so what?" question quite frequently. One of our other sets of action items was an indication that if society has and effectively uses this information on the dynamic nature of climate, we could very easily reduce our vulnerability, and that is a current vulnerability to climate. This vulnerability could be reduced now as well as in the future.

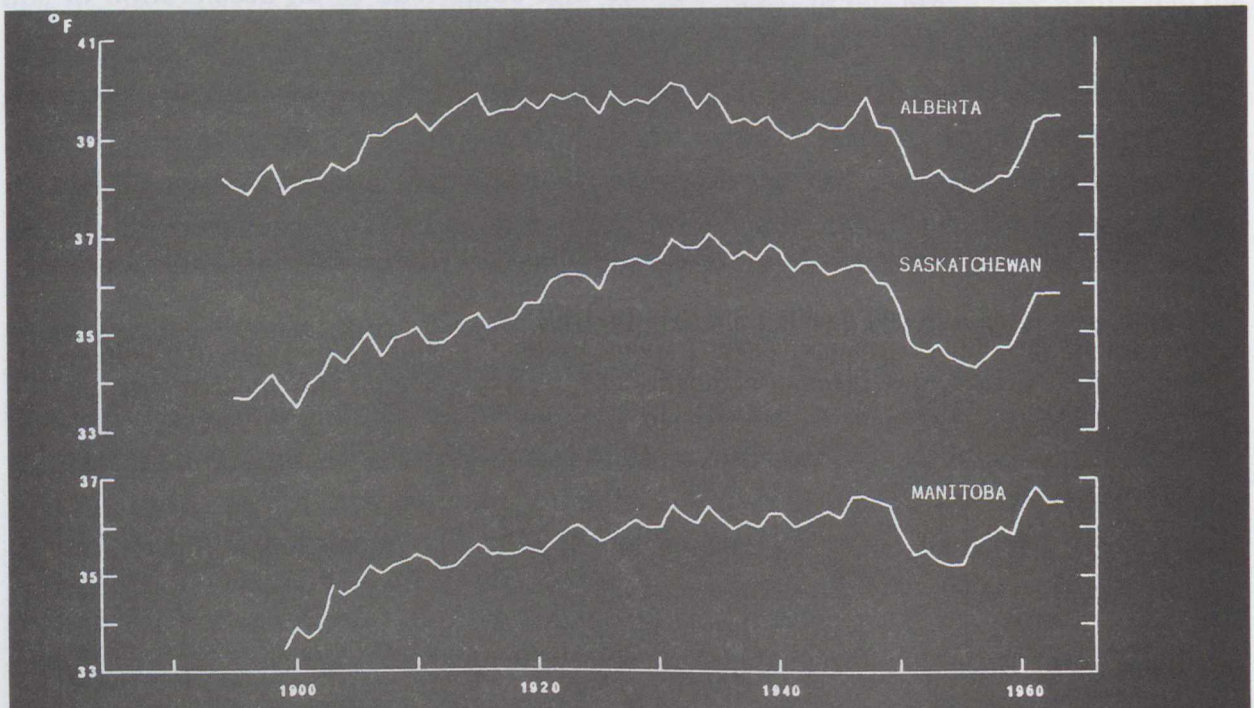
.2110

Another question that needs to be addressed is, how do we prepare for this climatic change? The climatic change impact assessments have a wealth of information which gives us some preliminary indications of what can be done in terms of improved agricultural farm level management, improved education awareness, and farm extension activities—improved policy types of steps.

In order to get to this stage, we certainly do need to have dialogue, not only between the planners, policy-makers and climatologists, but the entire range of other disciplines that are involved. This type of environmental change information needs to be more actively incorporated into strategic planning in order to promote this linkage between such work and planning.

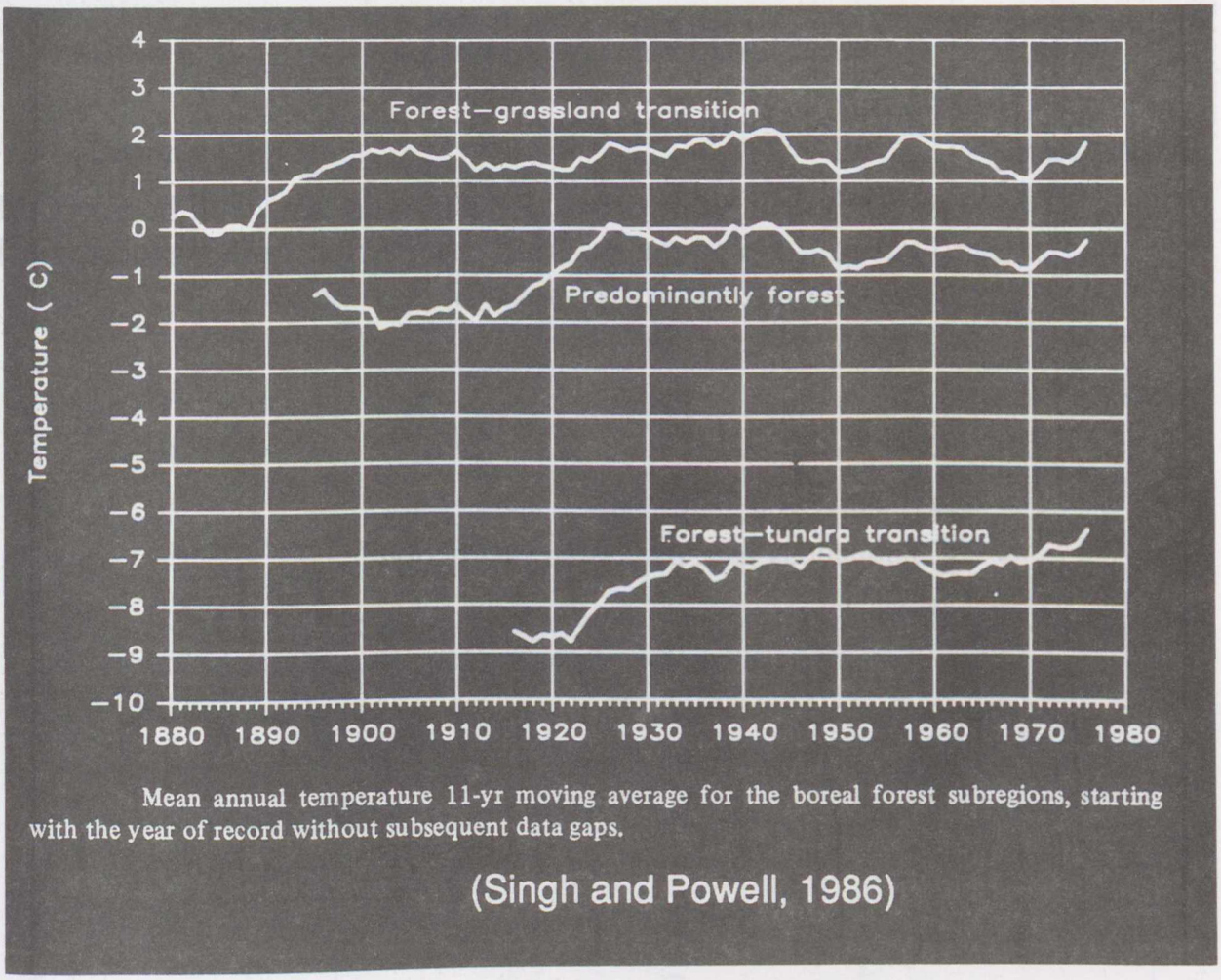
Certainly there needs to be an emphasis on the development of drought-tolerant crops. This is an example of one being looked at at Agriculture Canada—a more drought-resistant oil seed. Certainly there needs to be an emphasis in terms of water, soil, and energy conservation, and efficiency technology is one example. We need to continue to monitor the situation. We need to continue to monitor especially the extreme situations—the dust storms, the movement of the tornado belt northward.

I say thank you with a prairie sunset.



Ten-year moving means of annual temperature (plotted at the final year of each decade)

Source: M.K. Thomas, "Climatic Trends on the Canadian Prairies", WATER AND CLIMATE: A SYMPOSIUM, Report #2 (Saskatoon: Water Studies Institute, 1965) p. 35.



Mean annual temperature 11-yr moving average for the boreal forest subregions, starting with the year of record without subsequent data gaps.

(Singh and Powell, 1986)

Climatic change scenarios

Definition:

A description of the spatial patterns and seasonal behavior of temperature, precipitation, and other important meteorlogical variables in altered climatic state (Santer 1985)

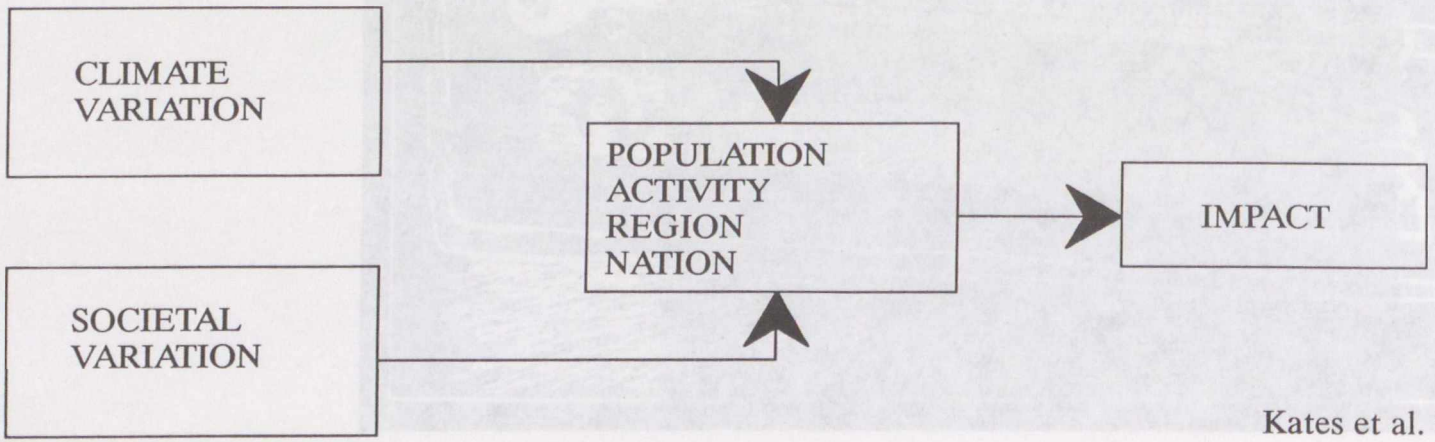
Types:

1. **Historical**
   - instrumental or paleoclimatic
   - e.g., anomalous year, five or ten year period
2. **Synthetic**
   - based on artificial combinations and/or adjustments to historical data
3. **GCM – Derived**
   - for $2^{x}CO_2$ climate simulations
4. **Hybrid**
   - combines aspects and advantages of above scenarios

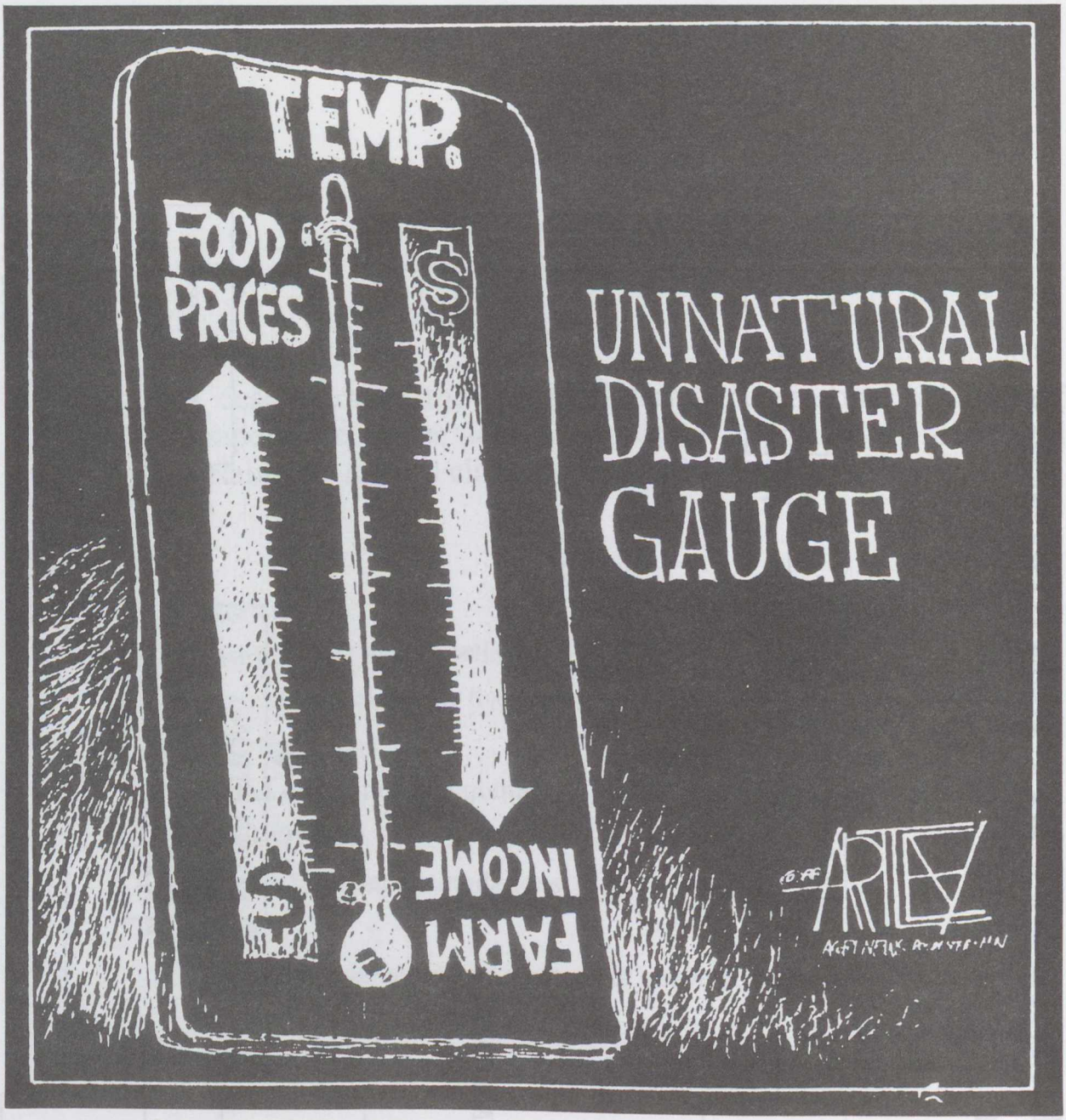
CLIMATE SOCIETY RELATIONSHIPS

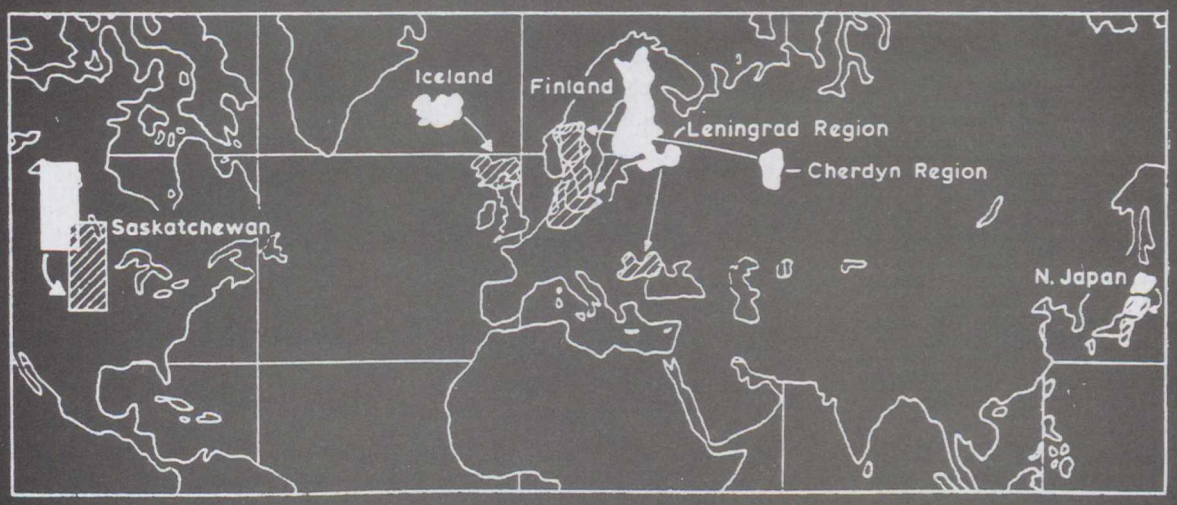
A. IMPACT MODEL

B. INTERACTION MODEL

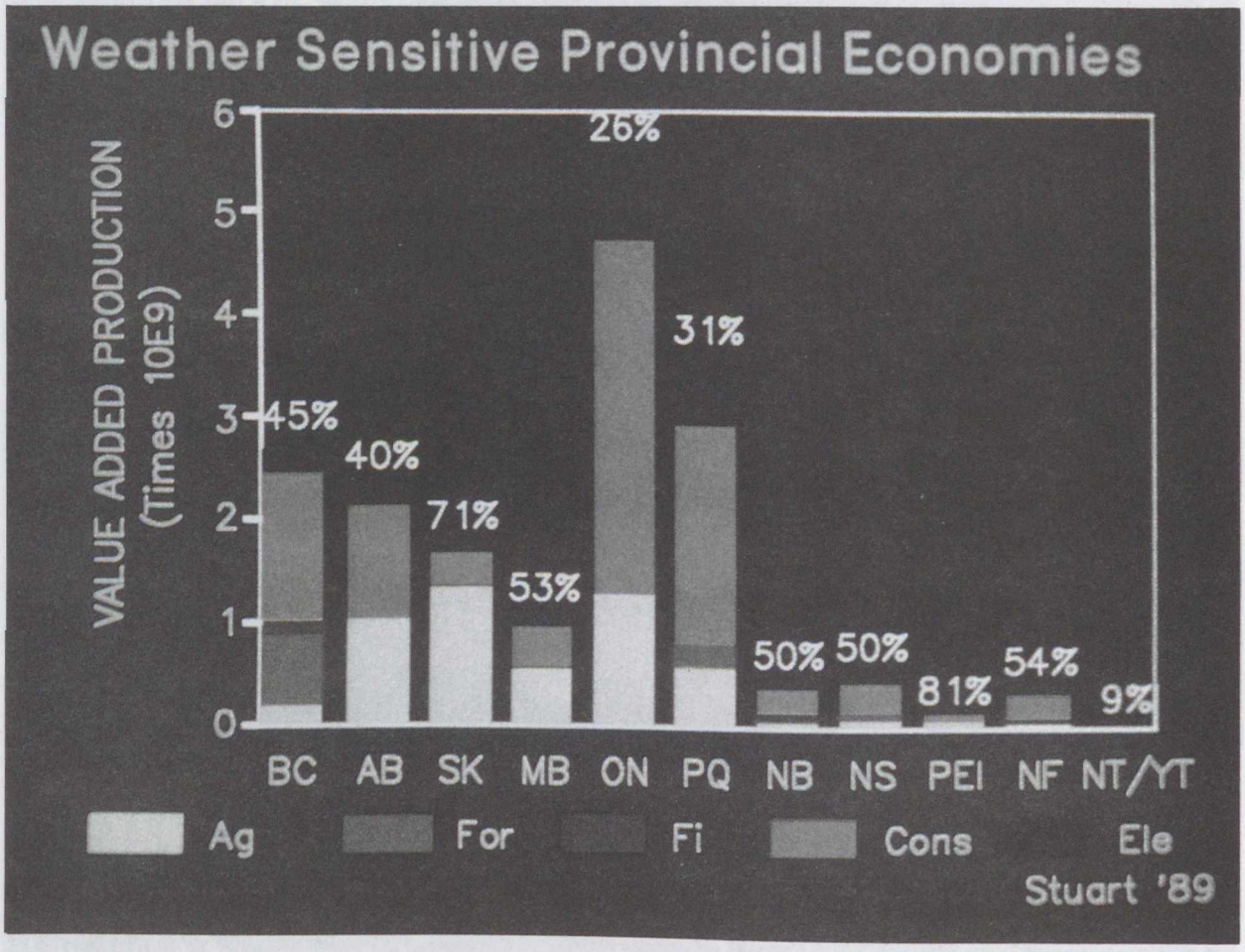


Kates et al. '85


TEMP.
FOOD PRICES
$
FARM INCOME
UNNATURAL DISASTER GAUGE



Present-day regional analogues of the GISS 2 x CO_2 climate estimated for the case study regions: Saskatchewan, Iceland, Finland, Leningrad and Cherdyn regions (USSR) and Hokkaido and Tohoku districts (Japan).


Weather Sensitive Provincial Economies
VALUE ADDED PRODUCTION
(Times 10E9)
0
1
2
3
4
5
6
45%
40%
71%
53%
26%
31%
50%
50%
81%
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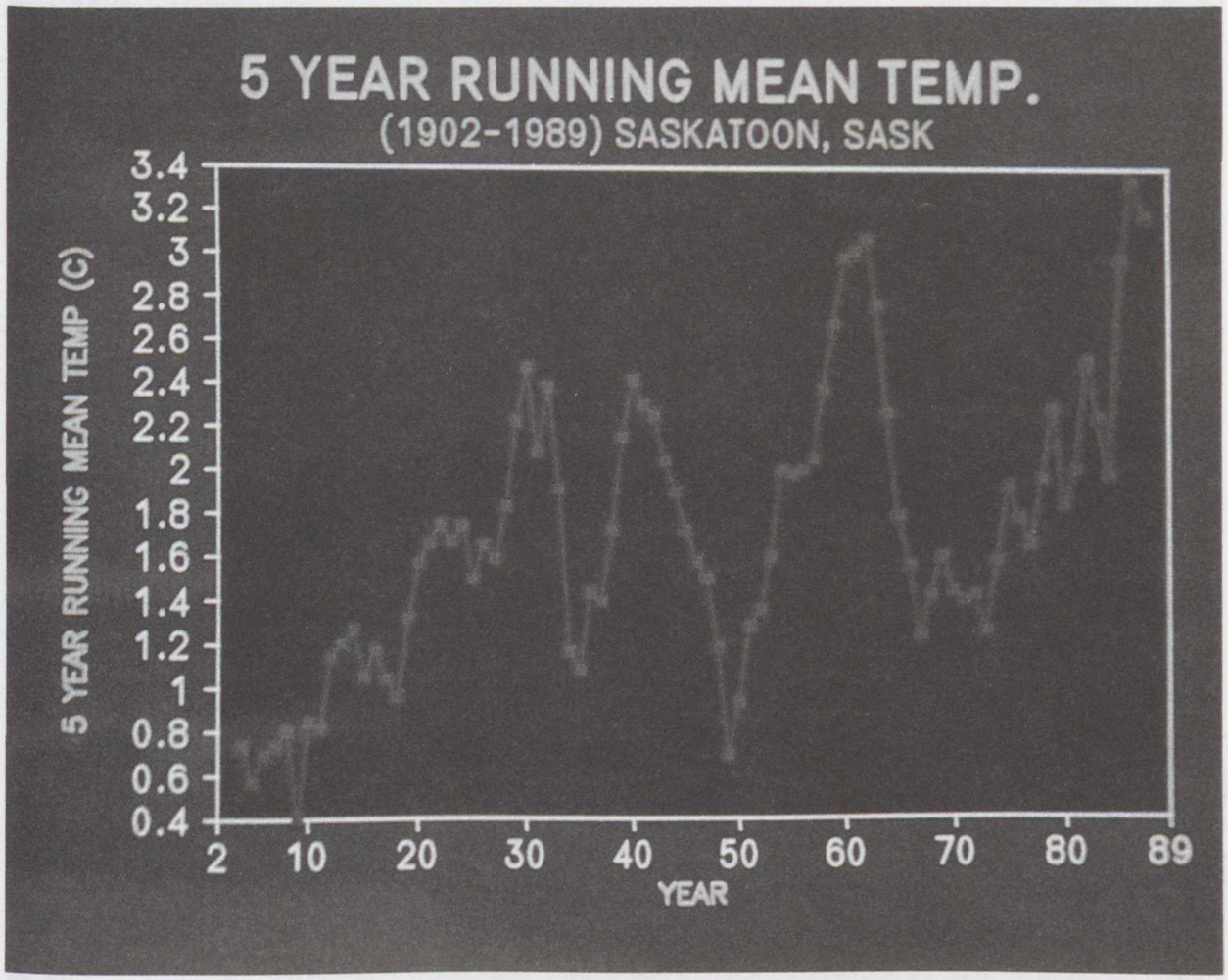
5 YEAR RUNNING MEAN TEMP.
(1902-1989) SASKATOON, SASK
5 YEAR RUNNING MEAN TEMP (C)
3.4
3.2
3
2.8
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30
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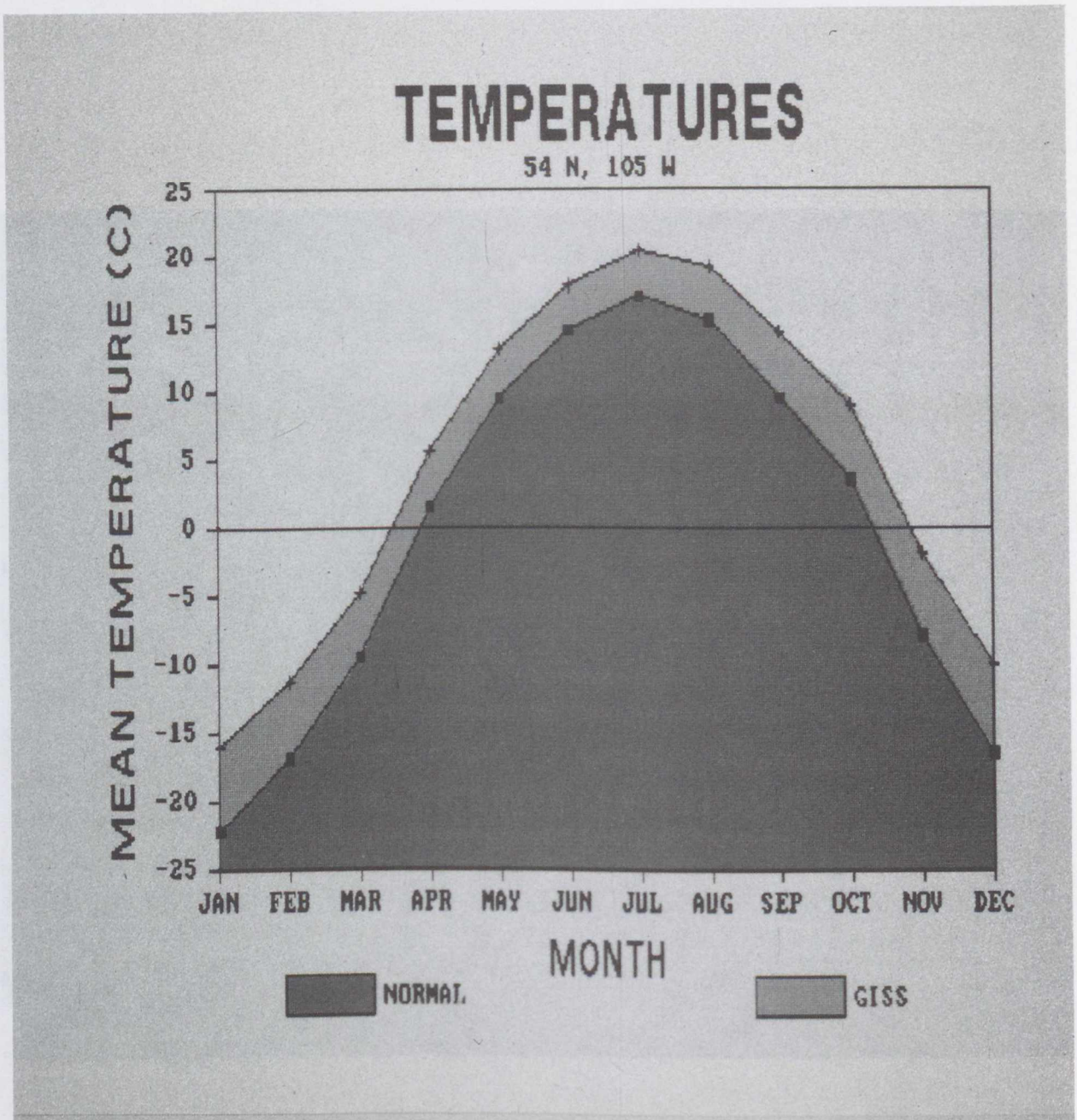
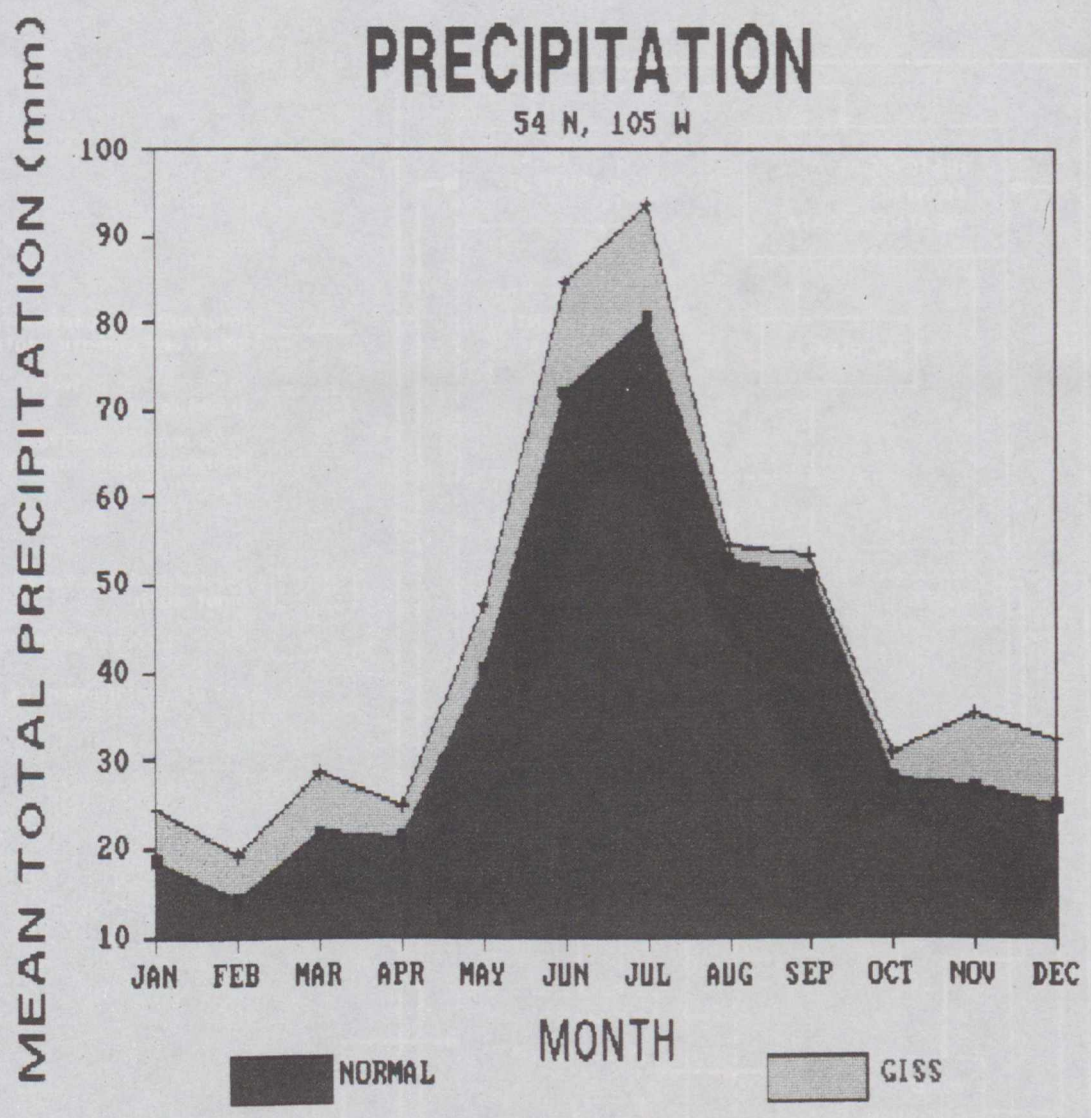
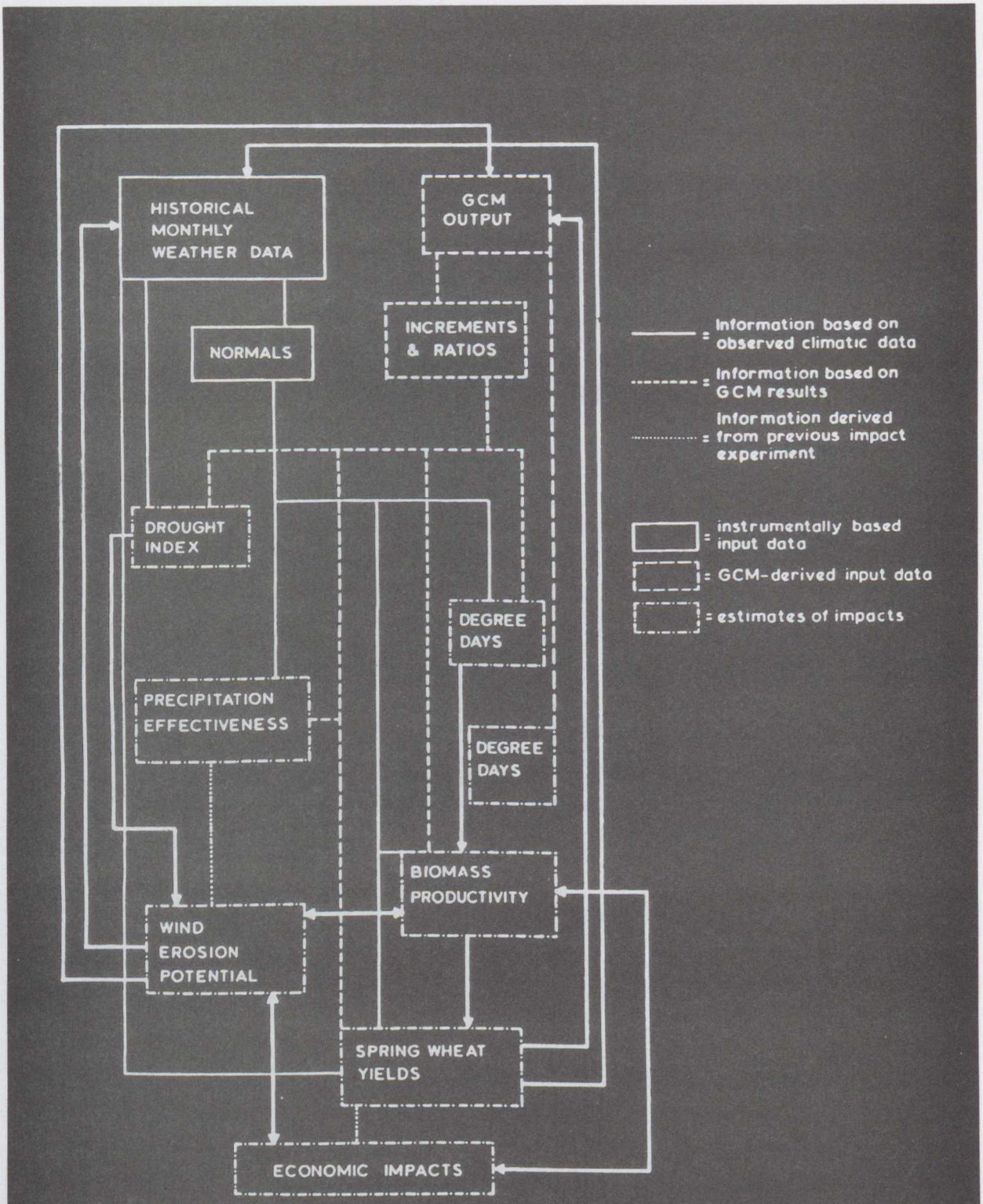
50
60
70
80
89
YEAR



SEASONAL CHANGES - COMPARISON OF THE 1951 - 1980 NORMAL (HIST) MONTHLY TEMPERATURES WITH GISS-BASED 2 X CO2 CLIMATIC CHANGE SCENARIO MONTHLY MEAN TEMPERATURES FOR A SPECIFIED GRIDPOINT



SEASONAL CHANGES - COMPARISON OF THE 1951 -1980 NORMAL (HIST) MONTHLY PRECIPITATION TOTALS WITH GISS-BASED 2 X CO2 CLIMATIC CHANGE SCENARIO MONTHLY MEAN TEMPERATURES FOR A SPECIFIED GRIDPOINT



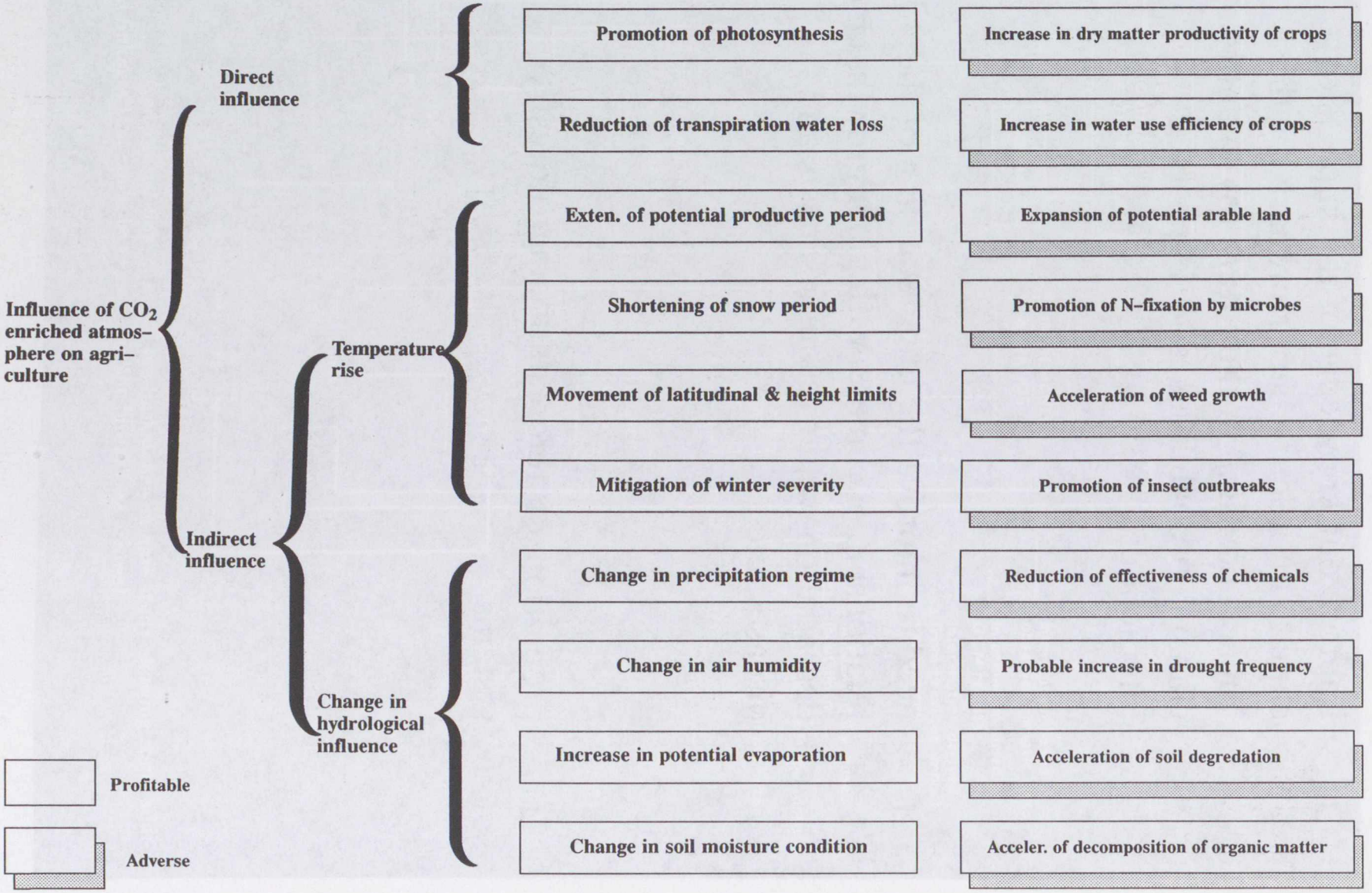
Generalized flow chart of the Saskatchewan case study showing some additional linkages that could be explored in the future (*see* arrows).

- ❑ improve our knowledge of the impacts of climate in order to better prepare for these impacts now and in the future (by quantifying climatic probabilities and impacts/ interactions).

- ❑ need to improve the understanding of the relationship of climate, with plant growth, land degradation, water resources, pests and diseases, etc.

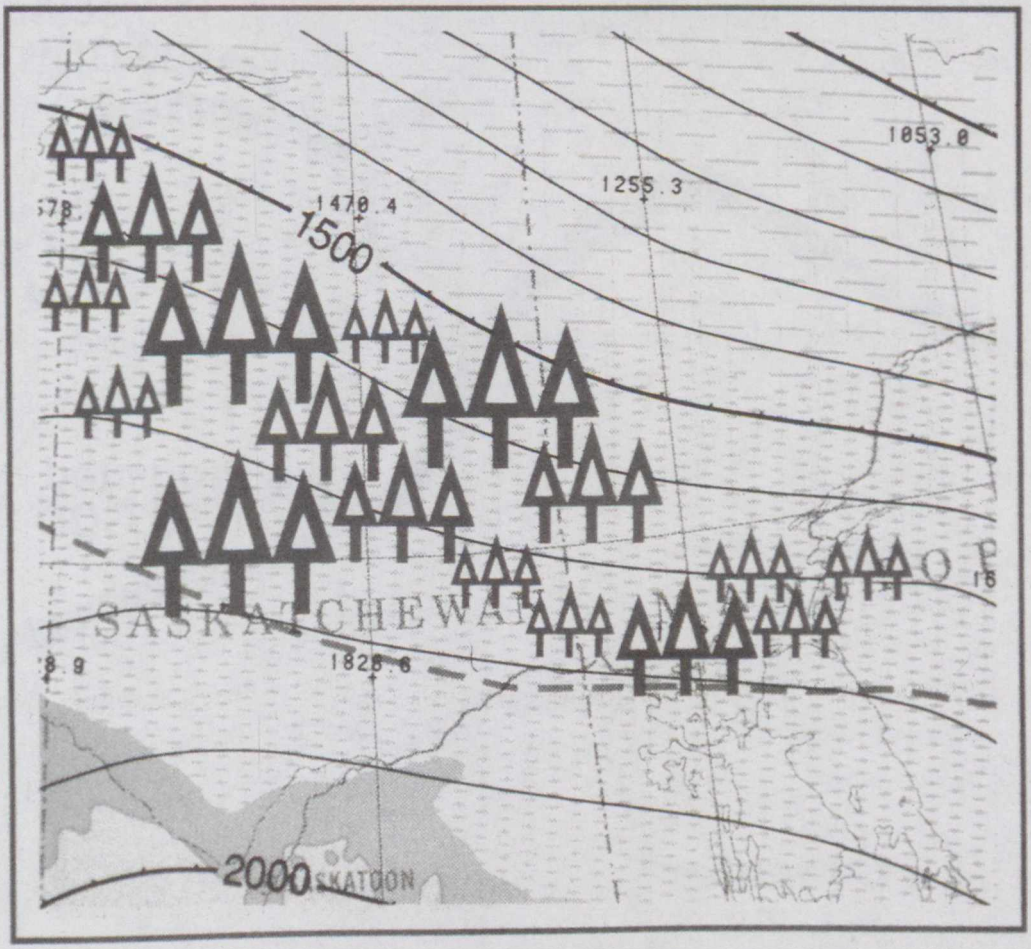
- ❑ promotion of reforestation/agroforestry systems.

Possible effects of increased atmospheric carbon dioxide on agriculture in Japan



Saskatchewan Research Council

An Exploration and Assessment of the Implications of Climatic Change for the Boreal Forest and Forestry Economics of the Prairie Provinces and Northwest Territories: *Phase One*

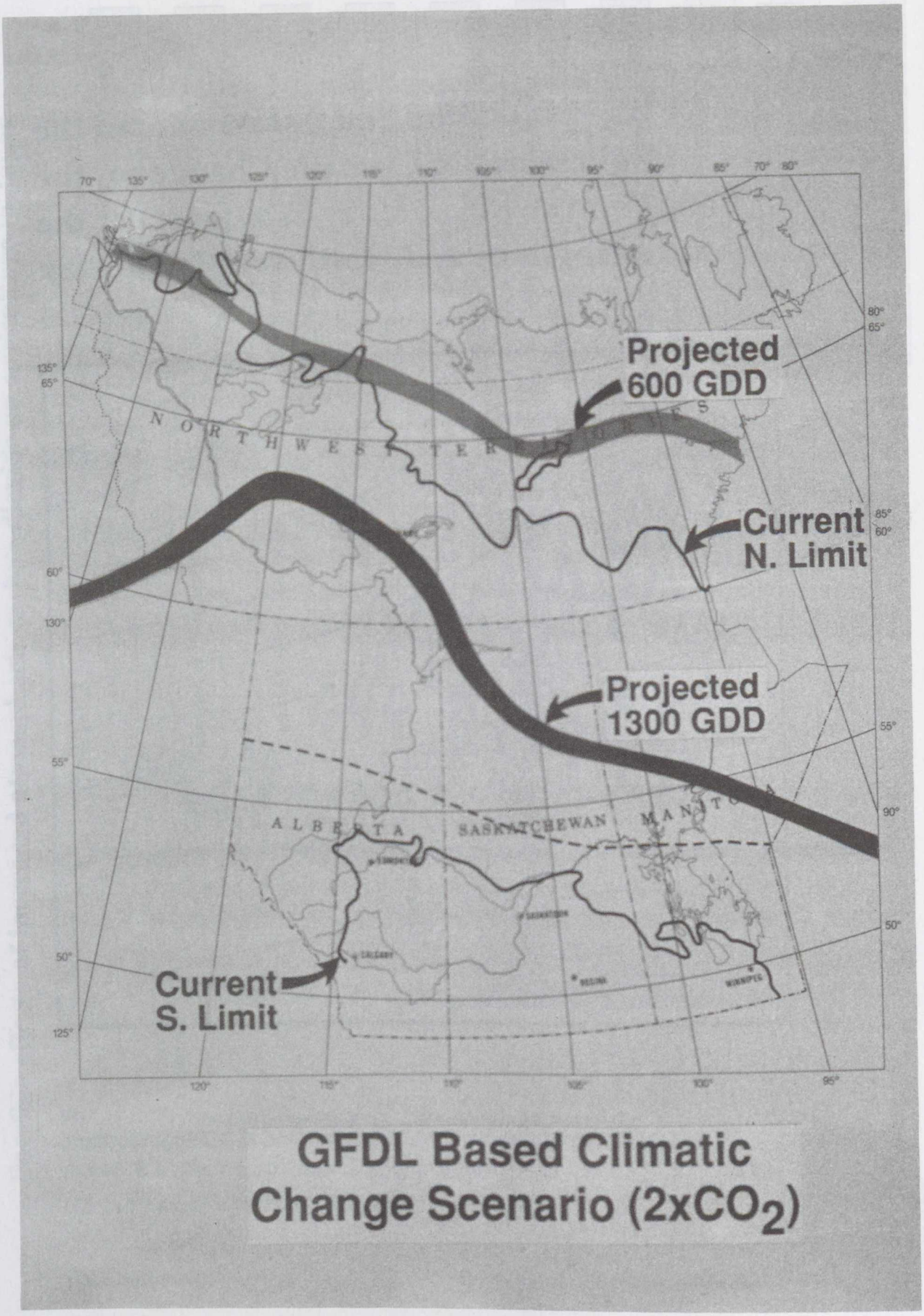


By
E.E. Wheaton, T. Singh and R. Dempster and K.O. Higginbotham,
J.P. Thorpe, and G.C. Van Kooten with J.S. Taylor

SRC Technical Report No. 211

SRC Publication No. E-906-36-B-87

November, 1987



GFDL Based Climatic Change Scenario ($2xCO_2$)

If society has and effectively uses information on the dynamic nature of climate and its effects, we will be able to decrease our vulnerability to climate and further benefit from climatic resources.

Preparing for Climatic Change/Uncertainty

❑planners/policy makers and climatologists should cooperatively develop user relevant climatic information. (interdisciplinary approach is critical).

❑incorporation of climatic information into strategic planning and management processes--greater need to manage risk.

❑need to use climatic information in relation to sustainable development strategies.

❑need for enhanced climatic/environmental monitoring.

❑water, soil, and energy conservation technologies encouraged.

❑needs of climatic refugees to be addressed.

❑reduction of winter stresses.

The Chairman: Thank you very much, Ms Wheaton.

I would like to ask you a question that could have been put to Dr. Maini. Do you think that a well-planned reforestation program could improve the situation for agriculture in the Prairies and remedy the conditions we have observed there over the last few years?

Dr. Maini: In the prairie provinces, after the 1930s dust bowl conditions, a lot of poplar shelter belts were planted. These poplars live about 30 to 40 years. These trees have disappeared from the Prairies as the size of the farms has increased and because the trees do not live very long. I believe by developing those shelter belts that at least some of the conditions can be improved; and Agriculture Canada has a program for supplying trees for the prairie people.

Mr. Foster: Ms Wheaton, your temperature calculations seem to indicate a climate change already of three to four degrees centigrade. Disregarding the big downward spikes in the 1950s, do you think we have reached the point in the Prairies, or at least in Saskatchewan, where we are seeing the more advanced kind of global climate change that is predicted over the next 10 or 15 years on a broader worldwide cycle; and if so, are we at the stage where we need to be making policy decisions to have larger amounts of land put into grass or into more permanent kinds of coverage that will not lend themselves to dust storms or to loss of crops to draught and so on.

.2115

Ms Wheaton: In terms of the climate of the 1980s, the climate of 1988 can be considered to be an analogy for what could be experienced more often well into the next century. The climate of 1988 had very similar types of climatic regimes, as might be expected, and as depicted on some of these diagrams.

In terms of what agricultural adjustments might be considered, it is quite possible that it is suitable to look at a range of adjustments, including returning some of that marginal land to grasslands. The National Soil Conservation Program has already started to address that. It certainly helps to deal with the dust storm problem. A combination of agriforestry, as Dr. Maini has suggested, would be appropriate in terms of not only making the micro-climate more suitable for crop growth, but of soil and water conservation, which are badly needed in the Prairies.

So a complex combination of many types of policy, agricultural extension, and educational programs is required to demonstrate the way such adjustment responses can actually result in improved yields.

Mr. Stevenson: I want to put myself within the growing consensus of major concerns over climate change and global warming, but for this particular question, I want to cast myself in the role of a sceptic and refer to some of the work done by the Canadian Wheat Board.

You will probably be aware that they have analysed yields in western Canada over the last several years and have taken out variation that they can attribute to improved

technology. They find the variability in yield is still well within the normal envelope of variation. I believe I am in correct in saying they have concluded that any effect of climatic change to this point is unmeasurable.

Is my interpretation correct? How do you interpret those results in light of the warming trends of the 1980s, in particular?

Ms Wheaton: In terms of climatic change that is beyond the current, very noisy envelope of our existing record, climatic change in terms of temperatures has not gone beyond that very extreme and wide band of noisy, natural variability. So there is no reason to expect yields to have gone much beyond that. That addresses the question of variability.

As Dr. Schneider said this morning, we should not expect, with a high degree of certainty, to be able to see the signature of an enhanced greenhouse climate change for 10 to 15 years. Neither should we see that change in yields, and perhaps less so, because they are driven more by moisture.

So the question you should ask is whether we can risk waiting out that time period in terms of lost opportunities and of impact on the rural structure. Can we afford to wait that long? The risk of waiting sometimes outweighs the cost of being prepared, especially when this type of preparedness can help us to deal with our present climate.

.2120

Mr. Caccia: Mr. Chairman, let us ask Ms Wheaton to put aside climatic change completely for a moment, and ask her to give this committee the benefit her views as to which policy she would recommend in agriculture and forestry to deal with topsoil degradation, contamination of ground water, and transboundary atmospheric pollution, on the basis of what we know now today.

Ms Wheaton: I will start out with soils. Even without a climatic change—and as we know, the climate is not stable anyway—even without the climatic force factors of the extra greenhouse gases a large part of the prairie provinces is in a semi-arid climate, which means that the possibility of dust storms and very severe erosion is quite high, even with the past 30-year base climate.

There must be very strong policies to make sure that our soils stay where they are, as best as we can. We can not afford that loss of principle, that the soil is a priority.

In terms of ground water it is possible that we are using our ground water at a greater extent than we should. That is very difficult to assess, as we have heard already. We are using it at much greater rates, of course, in the 1980s, because our surface water has been very limited.

With increasing population, increasing growth, we will have more emphasis on use of those ground water resources, because that is a primary source of water in the Prairies. Perhaps Dr. Maini can address the pollution and transboundary pollution.

Dr. Maini: I think the transboundary pollution question is fairly well established, that some of these pollutants are associated with some forest decline. In Europe there is more convincing evidence about it than we have in Canada, but they cause stress to biological systems and need to be prevented and reduced, because of not only the economic investment in this forestry state, but also from an environmental point of view there is a very important role that forests play. One would want to prevent airborne pollutants whether or not there is climate change.

Ms Wheaton: I will just add that in terms of that climatic change and variability, pollutants have a synergistic effect with respect to an ecosystem. If an ecosystem is under stress with respect to a climatic drought or whatever, and it is compounded by air pollution, it is subject to die back or suffer severe stress at a lot faster rate than if you had just climate change singly, or just air pollution singly. There is a synergistic effect of climate change and air pollution.

Mr. Caccia: Is it correct to conclude, then, that without climatic change we do not yet have in place the necessary policies to deal with topsoil degradation, contamination of ground water, and transboundary atmospheric pollution? Is that what you are essentially saying?

Ms Wheaton: For instance, we are still seeing evidence of massive wind erosion on the Prairies. Does that help answer the question?

Dr. Maini: I am not saying that there are no policies to prevent transboundary pollution. Within Canada there has been agreement with the various provinces on reduction of sulphur dioxide emissions, and similar steps are being taken in the United States. I would not say that there is nothing in place as far as transboundary pollution is concerned.

.2125

Mr. Caccia: How about contamination of ground water?

Mr. Fulton: Ms Wheaton, there is obviously a very substantial body of climatological information. You possess a great deal of it. There is an enormous body of soil moisture and soil erosion and ground water information available vis–à–vis our own prairie systems. One of the things I keep hearing when I talk to farmers, of whom there are not a great number in my constituency of Skeena—I can assure you that in Bulkley Valley there are not problems with soil moisture—is that the problems on the Prairies are getting more serious. I was just reading as I came here yesterday the fact that for every tonne of grain grown in Canada last year we lost 4 tonnes of topsoil. These are rather staggering statistics when you start looking at the macro impact of just what we are doing now.

Once you look in the eyes of a devilish global problem such as that of global warming—and much of our time this evening has been spent in talking about adaptation, trees moving up north of 60, prairie climate getting up into the Arctic, all these potential

and possible changes—do not you think, from a climatological perspective, that the political leadership in this country and in the provinces would be well advised to start doing some proper cost analysis of the impact of the various degrees of warming that we are talking about?

We know, for example, that in Canada we can meet two-thirds of the Toronto climate proposals of a 20% reduction of carbon dioxide by 2005. We can get two-thirds of the way there, saving money—saving $150 billion, or $5,000 for every man, woman, and child in Canada. But the fossil fuel mandarins have come to this government in particular and said: no, we will hear none of it; we are going to keep doing exactly what we are doing.

Do you not think that, from a climatological perspective, we should be going very strongly into some costing analyses so we can actually tell the farmers? I suspect that a lot of realtors know or are trying to get all of that information collated on a computer model so they know what value land will have in Saskatchewan, Alberta, and Manitoba under various climatological conditions. It is not that hard to put together. Do you not think we should be doing that on behalf of Canadian farmers and the Canadian public?

Ms Wheaton: In terms of adaptive responses and policies, anything we can do now to alleviate problems with drought will help us considerably in terms of costs, in terms of productivity, in terms of rural development. Anything we can do now will help us with those problems right now, as well as in the future. So let us address those.

Mr. Brightwell: I want to ask what I consider to be just a very practical question from the farming community. Assuming the changes are going to happen—and I remain convinced that if we are successful in meeting the parameters we have set out we will delay it.... We will not stop it; we will simply delay it. I think I heard Dr. Maini talk about we will have it by 2015 or we will have it by 2075, so it is going to come.

If the changes do come, will our farmers be able to pick up crops from other areas and grow them in the different environment? Or will we have to develop new crops to fit our particular needs? Particularly if it is quick, that first question becomes so important. If it was going to happen in 50 years then I would say the only way they can do it is to drag them out of other areas. They cannot develop them themselves. Can you talk around that a bit?

Ms Wheaton: Sure I can. In fact, I have been talking with our plant ecologists at various locations, both university and Agriculture Canada.

One of the primary adjustment experiments is indeed to look at other locations that might have similar climates to know what we could experience in western Canada into the middle of the next century. So we look not only at the crop varieties.... In fact, looking at the crop varieties that are used successfully there has already been done in terms of drought.

.2130

One problem, of course, is that the day lengths are considerably different. We might have to resort to some tinkering with the day-length gene to be able to use crop varieties

from, say, locations in Nebraska and southward. That is a limitation I gather is being addressed through biotechnology.

About the rapidity of the change, the change in terms of enhanced greenhouse effect could be occurring now. It is just that we cannot say for certain that it is happening now or what part is occurring now. The 2015, 2020 dates are approximate times within which we say we should be able to see that signature. That does not mean part of it could not be induced right now.

Mr. Brightwell: I accept that it is here now. My question is about how quickly the farmers can adapt. You have told me part of the problem, length of day. But except for length of day they should be able to grab the crops from other communities and grow them if there is a market for those crops somewhere in the world.

Ms Wheaton: Yes. The flexibility and quickness of response there should not be too bad, except.... One of the solutions I showed was a crop variety now being tested at Agriculture Canada called "sunola", which is a combination of the sunflower and canola, for a more drought-resistant oilseed. Work like that is very useful, but it will take another three years, or perhaps more, to get it to the farmers. So even though the adaptive responses by the farming community could occur quickly, whether or not we have those crops right now is indeed a question of five or ten years, in some cases.

Mr. Laporte: I have two questions. First of all, Mr. Fulton put out a figure saying for every million tonnes of grain grown we have lost four million tonnes of dirt or topsoil. Do you accept that figure?

Second, in your presentation you said Saskatchewan may find itself with the same sort of climate as South Dakota and Nebraska. Let us assume that is going to be the case. How long do we have to adapt to that type of climate? Then, you have talked about some of the changes, the sunola plant and so on. How long do we have to adapt to that, and are we making progress in making that adaptation?

Ms Wheaton: We are certainly making some progress towards that adaptation. Agriculture is fairly flexible and adaptive. But the question is whether it is adaptive enough with the existing market forces, with the existing type of management structures.

Mr. Laporte: How long do we have to adapt? You have to get your models correct. Ten years, fifteen years; five years, twenty years?

Ms Wheaton: The agricultural system is fairly vulnerable, as seen by the 1980s. I guess the question is then how much of a change would result in a significant impact. We have to address that question before we can say how fast we have to change.

As I indicated here, it would be a good tie-in strategy to adapt to the droughts we have now. Those droughts could become more prevalent, more intense, starting into the next century.

Mr. Laporte: So we are talking 10 years?

Ms Wheaton: Yes, we have only 10 or 20 years or so.

Mr. Laporte: Now, on my first question about the tonne of grain and 4 tonnes of topsoil, do you accept that figure?

Ms Wheaton: I have not heard that, but I know the losses are amazing. We cannot afford those losses. They not only reduce the potential productivity of the soil, they reduce its water-holding capacity. Many of the characteristics of the soil are very much damaged by these episodes.

Mr. Laporte: How much longer can we continue to sustain the types of losses we have had in topsoil before our agricultural base, the topsoil itself, no longer can sustain agricultural growth? What sort of timeframe are we into with that one?

.2135

Ms Wheaton: It depends on the land management and the success of policies.

Mr. Laporte: Assuming nothing changes.

Ms Wheaton: Assuming nothing changes and assuming a recurrence of the conditions of the 1980s, it is certainly not long enough; certainly in the order of tens of years is very short.

Mr. Hughes (Macleod): Mr. Chairman, I would like to direct my question to Ms Wheaton as well. Given that we are trying to set the stage for planning strategies to respond to change, dealing specifically with the Palliser triangle, the area of southern Alberta and Saskatchewan that you know so well, I have a short two-part question. One deals with the risk we face in terms of the decrease in the South Saskatchewan River basin and what we should be doing to plan for maintaining the existing human activity we already have in that river basin and to maintain the quality of water throughout the year. Perhaps you could deal with the question of the supply of precipitation and the impact on the river systems in southern Alberta.

Ms Wheaton: The question of hydrology and the effects of bringing down the results of a general circulation model to enough detail to provide us information on hydrology is very tenuous indeed. The initial work that has been done shows that the water supply could go either way, depending on what happens in the coastal areas. We do not have enough information to significantly address whether or not there will be an increase or decrease of water supply in the South Saskatchewan River Basin.

We do know there should be policies directed to make water supply systems more robust, more efficient and more water conservative, which would do us a lot of good right now.

Mr. Hughes: There are one or two such proposals out there right now that might help; is that not correct?

Ms Wheaton: I am not sure.

Mr. Hughes: I am suggesting specifically that management in the Oldman River valley is one specific proposal. I know there are two parties who sit at the table here today who, it would appear, would prefer to have a system where you have a dry river bed to walk across in Lethbridge with dead and dying fish, compared with a system where you actually managed the heavy spring run-off and used the—

Mr. Fulton: On a point of order, Mr. Chairman, this is Conservative policy he is going on watching or listening.

Mr. Hughes: I am simply asking whether or not there is a—

Mr. Fulton: It is drivel what you were just saying.

The Chairman: If you do not mind, we will accept one question from the floor.

Mr. Stevenson: To what extent does diversification of agriculture in the drier part of the Prairies...? I am specifically thinking more of increased livestock there and grassland. I suspect that with it certainly comes a bit more forage production and so on. To what extent does it mitigate or aggravate the situation there regarding soil conservation, demand on water and the various factors that will come about during climate change?

Ms Wheaton: It is quite likely that well thought-out diversification could have a very key role in dealing not only with the present climate but also with future climate and the effects of the variability of climate, which is very extreme in this continental climate region.

Mr. Bob Francis (Individual Presentation): Mr. Chairman, I am a farmer and a businessman from western Canada. The question I have is more of a generic question to any one of the panel members. In today's very competitive business market, the difference between the businessman's or an individual's success is usually measured between a few percentage points. How do we provide the economic incentive to an aboriginal nomad in Africa or a rural peasant in Nepal to not strip their forests when it is the only source of fuel to provide heat for their food? How do we provide the economic means for a Western Canadian farmer or a forester from Quebec to practise proper soil conservation techniques to improve the agricultural biomass when he is cutting his inputs to the bone in order to meet his next bank payments?

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As a businessman, I know I need to take better care of the resource base I am dependent on for my livelihood. My question to you is, how do I survive the business evolutionary process? If I do not utilize my resource base to its ultimate economic potential for the short-term, I will not be around to survive the long term.

Ms Wheaton: I will address the soil conservation problem. Saskatchewan farmers tell me that in order to have adequate soil conservation measures, they need a much improved return on investment. Part of the answer is that there are inexpensive measures for soil conservation that can be utilized at the same time.

So there are at least two different angles to this problem. The inexpensive ones should certainly be adopted. Improved education and extension can help with that.

Dr. Maini: In the Brundtland report and other discussions on sustainable development on a global scale, it is well recognized that unless we address the problem of equity and poverty in Third World nations we will not be able to practise sustainable development on global scales. So for the examples in Africa and Nepal that you cited, they have no choice. The imperatives of survival are such that it is a much more difficult problem to address. It probably requires a massive transfer of resources from north to south.

As far as our international competitiveness is concerned, the consensus in the business community is that we need to have a level playing field with our competitors. It is very difficult for us to rationalize very environmentally responsible behaviour when our competitors are operating in a pollution haven.

In OECD countries with which we trade the most some steps have been taken in the past to develop certain harmonization of pollution abatement policies and so on. We hope that kind of negotiation will take place in international forums to at least develop that level playing field with our competitors.

Mrs. Linda Pitney (Individual Presentation): I have two environmental educational hotlines. One is in Toronto and the other is in Ottawa. Over the months I have had the opportunity to receive responses from Torontonians and Ottawans regarding what they want.

Without question, people want to learn. They want to contribute. They are not that ready to adapt to the greenhouse effect and to destruction.

I would like to ask the panel what you can offer me, especially regarding trees. What can I pass on to my line as far what the public can do? Can they plant trees? I know the pollution in Toronto is so pathetic that the little ones die right off. Can people plant trees in this region? Is there anything I could pass on to my people regarding agriculture? What can the people do? If you can give me any help along these lines I would really appreciate it. Thank you.

.2145

Dr. Maini: Mr. Chairman, I suggested about 10 actions that we can take as individuals and collectively as institutions, and I will be pleased to provide you with a copy of my notes for this evening's presentation.

At the same time, a number of environmental groups are undertaking tree planting programs in the communities. There is a notion that is emerging of community forests and the greening of urban and pari-urban Canada. I just heard of a mission by Greenpeace from British Columbia, who are embarking on this kind of program. I can give you some addresses you can write to.

Ms Wheaton: I will give a brief answer with respect to agriculture. As you may know, agriculture is part of the problem. There are greenhouse gas emissions resulting from changes in land use and other things related to agriculture. So agriculture has a role in slowing down the enhancement of the greenhouse gases. Agriculture has its ameliorative role to play and can play an active part, as does forestry, in helping slow down the greenhouse gas, climate warming problem.

Mr. John Hollands (Member of the audience): Mr. Chairman, I have a question for Dr. Maini.

You mentioned that a one degree Celsius change in temperature would likely move the frontier of a forest ecosystem by 100 kilometres. We foresee changes of between 1.5 and 4.5 degrees some time during the next 50 years perhaps. That means certain kinds of forestry, to adapt, would have to move through between 150 and 450 kilometres in 50 years—10 kilometres a year at the maximum. Can forest ecosystems move that fast?

Dr. Maini: No. This is in my introductory remarks. I have indicated that the rate of change that we are anticipating is far greater than anything forests have experienced in the past. I also noted that the prairie kind of climate will move further north if the world unfolds the way the scientists predict. The species will not move immediately because there is a time lag, but over a few hundred years there could be some drastic changes in composition. What we would see is perhaps a slowdown in the growth of some of the trees. Some species might disappear, not reproduce, but the adjustment process will take several hundred years to take place.

Even after the last glaciation, the vegetation is still moving in central Canada. It has not really caught up with de-glaciation, for example. So it takes several hundred thousands of years for vegetation to catch up with climate change.

Dr. Boulva: Mr. Chairman, I have an observation on which my colleagues may wish to comment. My observation deals with forests, agriculture and fisheries.

Basically, the climatic models we have heard about today focussed a great deal on temperature, a little on precicipation, but hardly at all on winds. I think that the current models, although still rather vague, are much more accurate in forecasting future temperature changes.

If you think about it, you can see that a major increase in top wind speeds could be extremely harmful for agriculture, forests or fisheries. Climate experts now think that the average speed of winds will diminish somewhat, but that extreme occurrences, such as storms, could increase in force.

I am sure you have read in European magazines about whole forests and entire crops laid waste by the storms that occurred in February 1990.

We spoke about the tornado belt moving northward. We know that our fishing infrastructure situated near our coasts is extremely vulnerable to rising water levels

combined with severe storms. A number of our cities are near the coasts and could be seriously damaged by this type of occurence.

I would suggest to the committee that it study this phenomenon and try to predict more accurately the future nature of these winds. It might be necessary to give some priority to this field of research in the next few years. It would be advisable to get more accurate data from wind models.

Dr. Maini: Mr. Chairman, I fully agree with Dr. Boulva; we do not have a lot of information on wind speeds. Most models deal primarily with changes in temperature and precipitation. This is a field that is not widely known, and one in which I think we must expand our knowledge.

The Chairman: Thank you. Tomorrow's meeting will begin at 9:45 a.m. Appearing will be Dr. Louise Arthur, who will speak on the greenhouse effect; Dr. David Bates, who will speak on the effects of air pollution on health; and Mr. David Runnalls, who will speak on sustainable development.

Ladies and gentlemen, I thank you for your patience and your encouragement, and I thank our speakers for their learned words.

The meeting is adjourned.

JOINT COMMITTEE SESSION III

Labour, Employment and Immigration

Health and Welfare, Social Affairs,
Seniors and the Status of Women

Environment

Tuesday, April 24, 1990

.0954

The Joint Chairman: Order, please!

I should like to welcome all the participants. This morning, we are resuming our Parliamentary forum on global climate change with the joint participation of three Standing Committees: the Standing Committees on Labour, Employment and Immigration; Health and Welfare, Social Affairs, Seniors and Status of Women; and Environment.

We will focus on the impact of climate change in the areas of particular interest to these three Standing Committees, that is, Employment and Immigration, Health and Environment.

This morning, we have three speakers: Dr. Louise Arthur, Dr. David Bates and Mr. David Runnalls.

Dr. Louise Arthur teaches agronomy at the University of Manitoba's Department of Agriculture, Economics and Farm Management. She is specialized in environmental and resource economics. She has written numerous articles on the socio-economic impact of global warming, more particularly, on the agricultural sector, leisure activities and immigration.

Mrs. Arthur, it is a pleasure to see you here. You have the floor.

Dr. Louise M. Arthur (Department of Agricultural Economics and Farm Management, University of Manitoba): Thank you. I hope you will not decide not to burn me at the stake after this speech.

I will be a little different from the previous speakers in that I was asked to talk about impacts, on which I do most of my research. I am not a climatologist, so I do not look at the world effects of weather. Because of that, I have to look at who will benefit from the greenhouse effect, as well as who will not benefit from it. Unfortunately—or fortunately, depending on your point of view—Canada is probably one of the major beneficiaries of the effect, and this fact is recognized world-wide.

I noticed yesterday that the first two speakers mentioned that one-third of Canadians think we will actually benefit from climate change and one-third of the audience laughed. I do not know if that is the same one-third that thought they would benefit and were a little embarrassed about it, or whether it was the one-third that thought it was a ridiculous idea. Nevertheless, one-third of you laughed and I was a bit surprised, because it is fairly widely recognized that we will probably benefit from the greenhouse effect—not in all sectors or in all regions, but in aggregate someone will benefit, and it is likely to be the U.S.S.R., northern Europe, and Canada.

That does not mean I am suggesting we go ahead and pollute or that the more pollution there is, the better. We would like this to happen very slowly, if it happens at all, and we are

interested in the whole world economy because we are tied into it. So we would like the whole world to be a healthy place and would like any change to happen so slowly that we can adjust to it easily without any major program changes.

We still admit that we might benefit from the effect. I do not think that is asking too much. Imagine the effect of a Toronto protocol, in which we ask for a 20% reduction in carbon dioxide emissions in the face of the fact that we are actually benefiting from the greenhouse effect That request does not hurt our position. We say we will be magnaminous and will be world leaders in suggesting cuts in carbon dioxide and in acting personally on cutting carbon dioxide emissions even though we know we are benefitting from global warming.

That comment is a bit off the subject. I am supposed to be talking about labour impacts of the greenhouse effect. Unfortunately, labour impacts occur in regions on a very small scale. We are not talking world labour impacts; we are talking western Canadian labour impacts. All the good climate-change models are most accurate at the world scale, but I have to bring those down to a regional scale to deal with them, because it is regional economies that dictate labour demands and supplies.

.1000

I have to take those world models of climate change and try to get the regional effects out of them. This can result in a lot of different effects, depending on which model you use. Looking at five different general circulation models for North America, which had to do with summer soil moistures, different models gave me different results.

Dr. Schneider yesterday showed you a drier scenario. Why he did not show you his own model from NCAR, I am not sure. Some models show the regions actually getting wetter. In fact, almost all these models show a wetness increase in the winter. These are the types of effects I am extrapolating from. I have to take these North American effects in Canada, and particularly in the Prairies, and see what the effects are. If we have more soil moisture in some of these scenarios, even if it comes in the winter and is still available in the spring for plants, I am going to get benefits whether they are caused by man or nature. So I have to say there is a positive effect, even if man is causing this change, though we do not like man causing the change. There is a lot of disagreement about what happens locally, so normally you have to take several of these scenarios in order to look at the impacts. You are going to get varying impacts depending on which model you use or which scenario you use.

Because these are long-term effects, we cannot really do economic forecasts. As you know, we are not very good at forecasting economically for three weeks, much less for 50 to 100 years, so nobody tries. All we try to do is simulate what happens if weather changes. We take the current economy with all its policies and institutions and we put a new climate on it. So it is not the same as the climatic models themselves, which actually try to forecast change. It just takes this end point of climate change, puts it on today's economy, and tries to see what would happen.

For example, for agriculture or forestry it just runs from weather. So all we consider is climate, which does not cause crop changes or forestry changes. Weather does, so we have to translate climate into daily weather events. That produces different crop yields, crop choices, sectoral responses, incomes, and labour demands. So by the time we get down to labour we are a long way away from our original scenario starting point of climate change. But this is all we have to work with, so this is how we do the simulating of economic impacts.

Obviously this is going to bring about a mismatch between the time and distance scale of the climate change and our understanding of how sectors respond to weather at the plant level. If I put heat and water on a little plant in a greenhouse, I know how it responds. But here I am supposed to determine how labour is going to change based on that plant response. That is how the simulation occurs. You know it is going to have lots of problems, but that is our level of understanding at this point.

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So we do some simulations of how different components of different sectors react to climate. I will give you some results from some studies I have been involved in and from some studies other Canadians and other North Americans have been involved in on how Canada's sectors are going to respond in the face of climate change.

This is what you have been told will happen. Probably southern Saskatchewan, maybe the very southern part, and possibly southern Alberta will dry up totally like this, but most of the models are predicting more productive agriculture, longer growing seasons, more high-value crops—so basically benefits to the agricultural sector. Again, this would be good news after decades of negative effects on agriculture. I would like to let us give them a break and admit that they might benefit for a change from something.

In terms of hydroelectric power, this happens to be the first dam in the U.S., but it was the only damn picture I had. The northern developments are expected to have less ice and more flow, so should be able to produce more power. Estimates for James Bay have been an increase in 20%. Now, there will be some losses in the Great Lakes region. There is supposed to be less precipitation, so there could be some losses in supply there. Demand is supposed to decrease in the winter but rise in the summer, so there may be an offsetting effect there.

In terms of mining, there are not expected to be major changes because mining is not particularly sensitive to weather. But costs of northern mining are expected to decline because of less need for ice-breaking and fewer permafrost problems. It will be certainly easier to explore for new mining developments in the north.

In terms of forestry, Dr. Maini yesterday mentioned that forests could probably benefit from increased productivity under climate change, and then he quickly said that we do not know for sure. We do not know anything for sure in this scenario of climate change, but if we take the best guess, the best guess is now increased productivity. Now, it does not necessarily benefit the Canadian forest sector; it benefits consumers, in that there will be

more product available at lower prices, but it could end up costing the forest industry in terms of profits. So there are some beneficiaries and some losers in the forest industry.

In terms of fisheries and aquaculture, unfortunately I could not understand—I heard it, but I could not understand—the fisheries speaker yesterday, so I do not really know what he said. I hope I am not contradicting him, but most of the studies I have seen have shown increased productivity in fisheries and acquaculture. Now, there will be some drying up of lakes, particularly in the Prairies, so there will be losses regionally, but the deep sea fishery is expected to be slightly more productive and some inland fisheries are expected to become more productive.

In terms of recreation, demand for water recreation is of course going to increase in the summer. The summer recreation season will be longer, so a lot of areas will benefit. The losers in the recreation sector are probably the ski resorts, particularly in lower elevation areas such as in Quebec. They are expected to lose a lot of their ski season and have to create more snow, so higher costs as well.

In terms of transportation, some of the northern ports will benefit. For instance, Churchill, Manitoba, is predicted to have up to an eight-month shipping season and much lower ice-breaking expenses, while some of the more southern routes, such as the Great Lakes, will be losers because of greater costs of dredging. They will have a longer season, but it will be a higher-cost operating season.

.1010

The wildlife sector is not a big employer, but to round off the resource sector I should say something about the effects on wildlife. There is some concern that the wildlife effects may be negative. A lot of our wildlife species are protected by being enclosed in reserve areas or national parks. As habitat moves northward, the habitat for these species may move out of the protective boundaries. So we may either have to redefine our reserves or lose some of our protected species.

In general, agriculture and forestry are the biggest beneficiaries. They benefit not only from higher productivity in more southern areas, but also from northern expansion. There are areas in which we have decent soils that could support agriculture if the growing season could be made long enough to plant anything profitably. Of course we do not have the infrastructure in there yet. We do not have the elevators and the roads. But if the change occurs slowly enough, these types of expansions could occur as they did in the past.

Forestry is also expected to move northward as the forest grassland fringe moves northward. As we move our infrastructure northward, it will be easier to exploit those northern areas.

So what does this have to do with labour? The only way we can get to labour demands at this point is to extrapolate from productivity effects to the demands for labour. The demands for labour are directly related to our output, our sales, and our profits. Because

Canada is a resource-based economy, if our resource sectors benefit, our economy is going to benefit. The demand for labour is going to increase in the resource sectors. Then there are all the sectors that feed into the resource sectors. Some provide inputs to the production from our resources, and some market the outputs of our resources.

This is just a summary of some of the effects from all the impact studies that I have been able to find for Canada. This is still a very uncertain issue. We are not sure when all this is going to happen, who the winners and losers will be, or how we should go about solving the issue. I do not think any drastic action is warranted, but I do not think a 20% reduction in carbon dioxide emissions by the year 2005 is particularly drastic. Our focus in labour should be on maintaining our resource base, so that we will have it available for the future, when it is probably going to be even more valuable and productive than it is today.

Now, we still have to be careful to identify the losers in this change process. We have to be prepared to take some of the winnings from the winners and compensate some of the losers. So I think we need to do more work on identifying winners and losers and setting up schemes for compensation or assistance in adjustment.

I also think Canada can play a role of leadership in slowing the climatic changes. I think it is easier for us to do this from our position as net beneficiaries of climate change. We would not be seen as doing it just to save our own necks but to help out the world.

Just to put in a plug for trading of pollution certificates, I think that is a possible way of doing it. I do not see the market as being a source of judgment about morality or immorality. People pollute and industries pollute because the market rewards them for polluting, and if we can shift the rewards to not polluting they will quit polluting.

.1015

Finally, I just think we need to continue to try to understand the climatic changes, where they are going to occur, when they are going to occur, who is going to benefit and who is going to lose, so we can assist the world in adjusting to these changes.

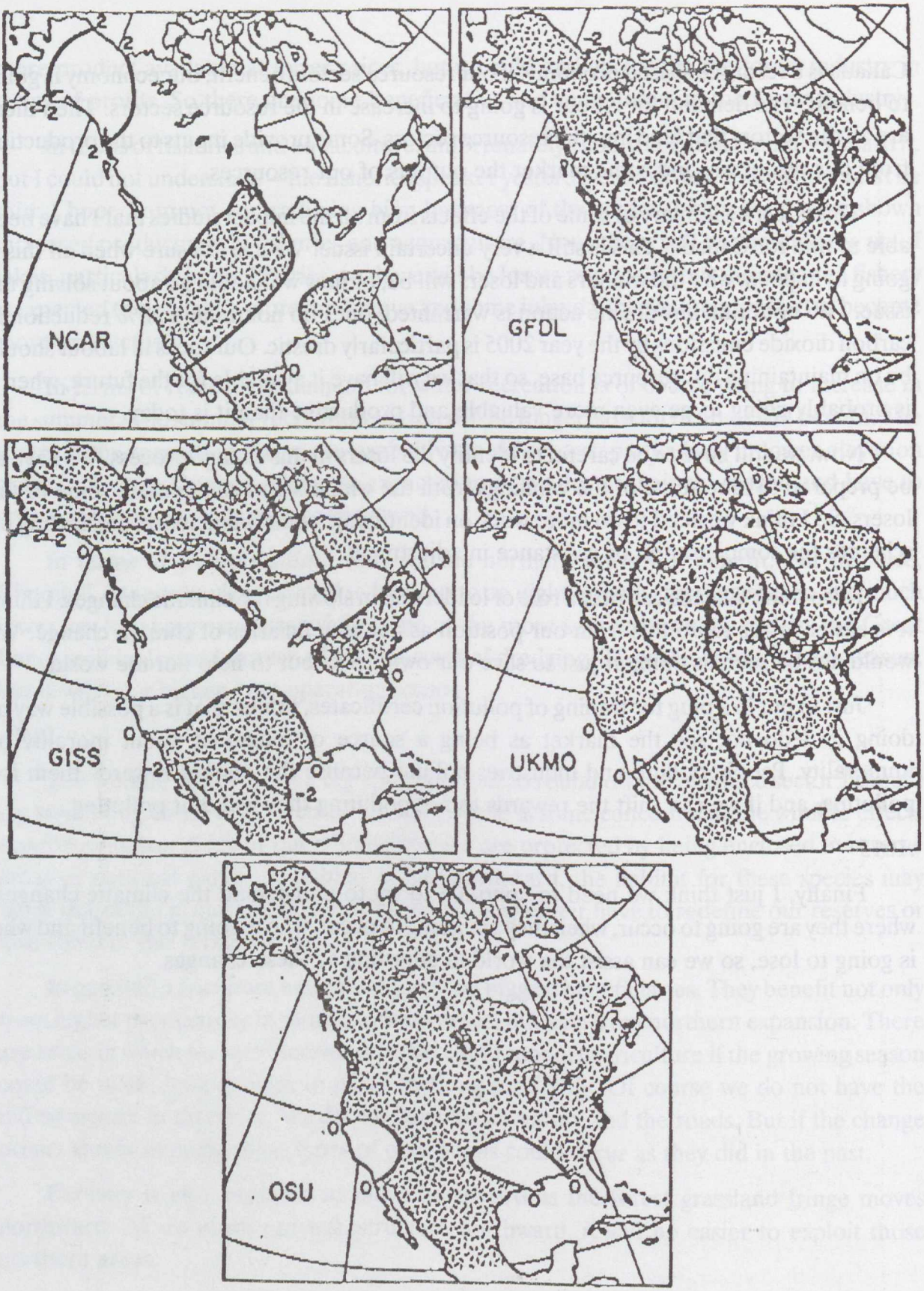
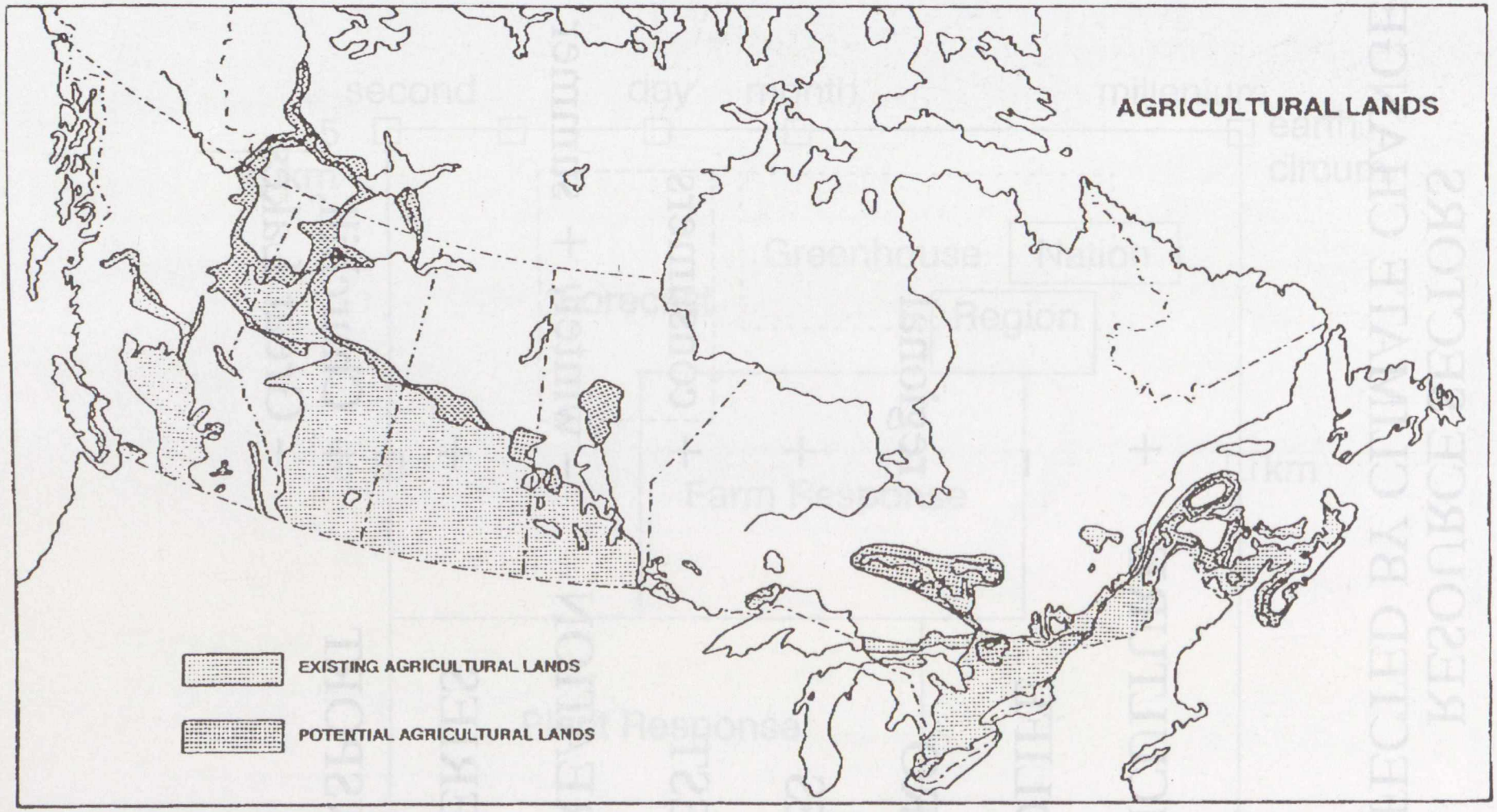


FIG. 6. As in Fig. 5, for summer.

Soil moistures: stippled = drier

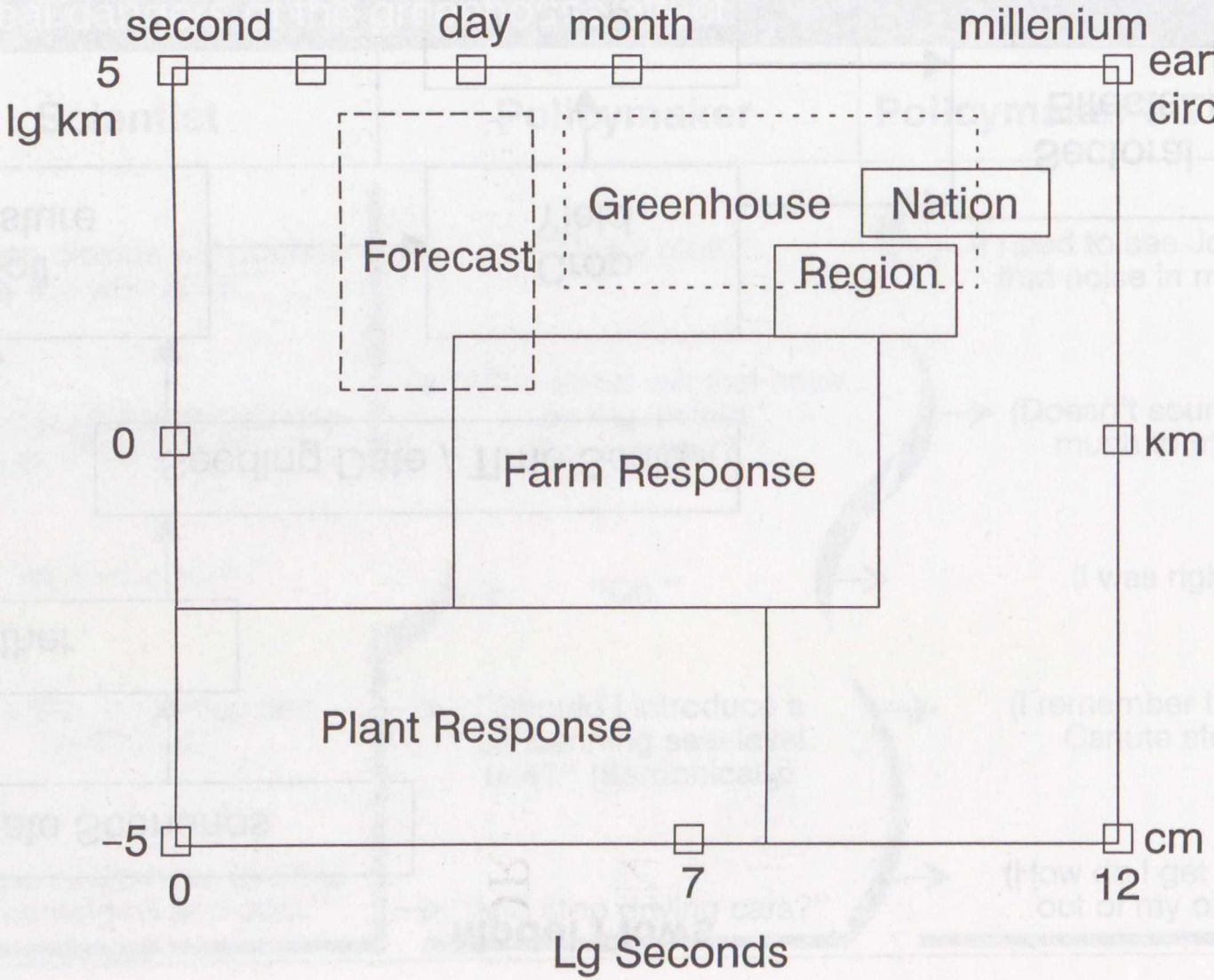


A warmer climate would expand the northern limits of agriculture into areas where soils are suitable.

Source: Environment Canada

RESOURCE SECTORS AFFECTED BY CLIMATE CHANGE

AGRICULTURE	+
WILDLIFE	–
HYDRO	regional
MINES	+
FOREST	+ consumers
RECREATION	– winter, + summer
FISHERIES	+
TRANSPORT	+ Churchill, – Great Lakes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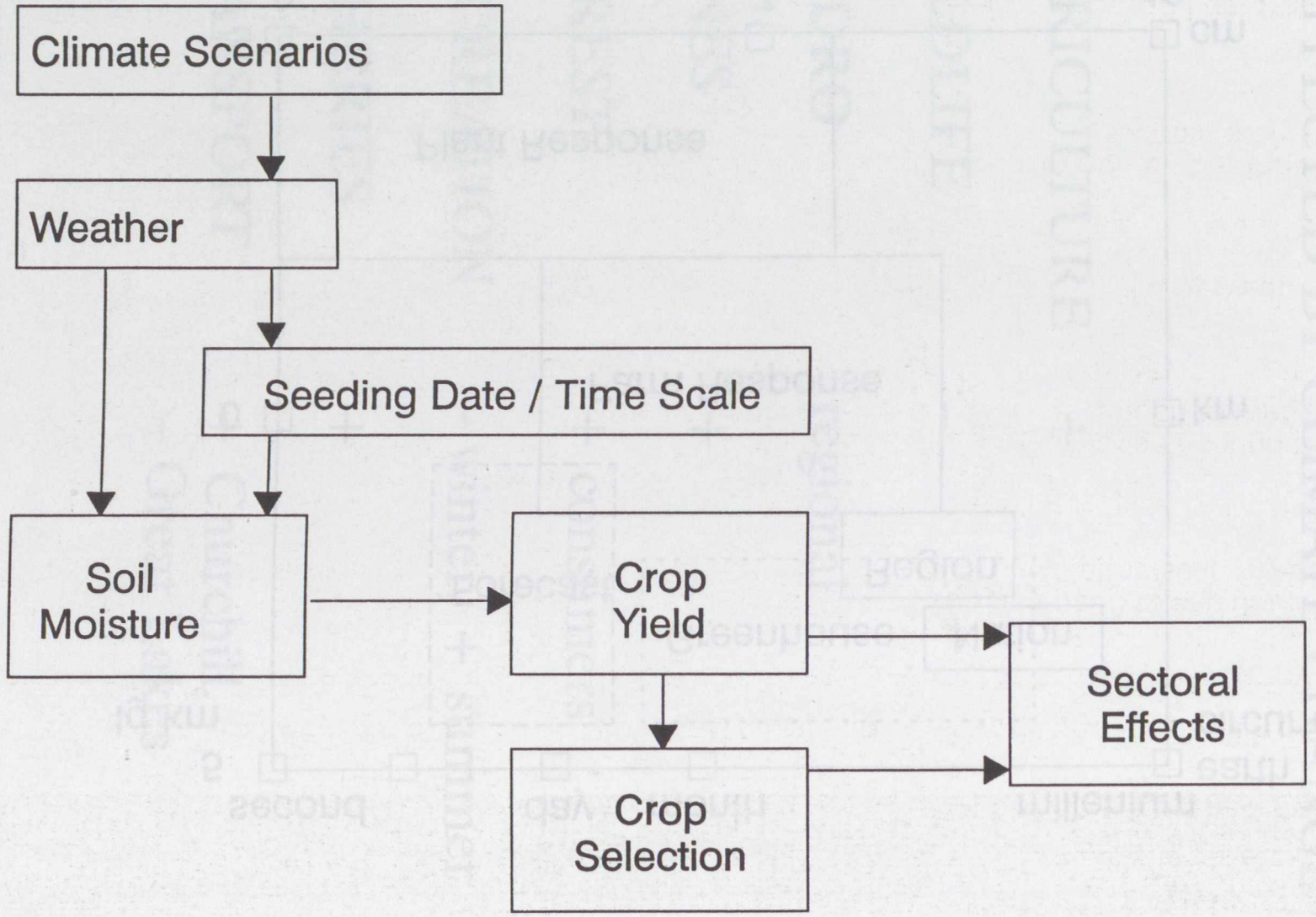
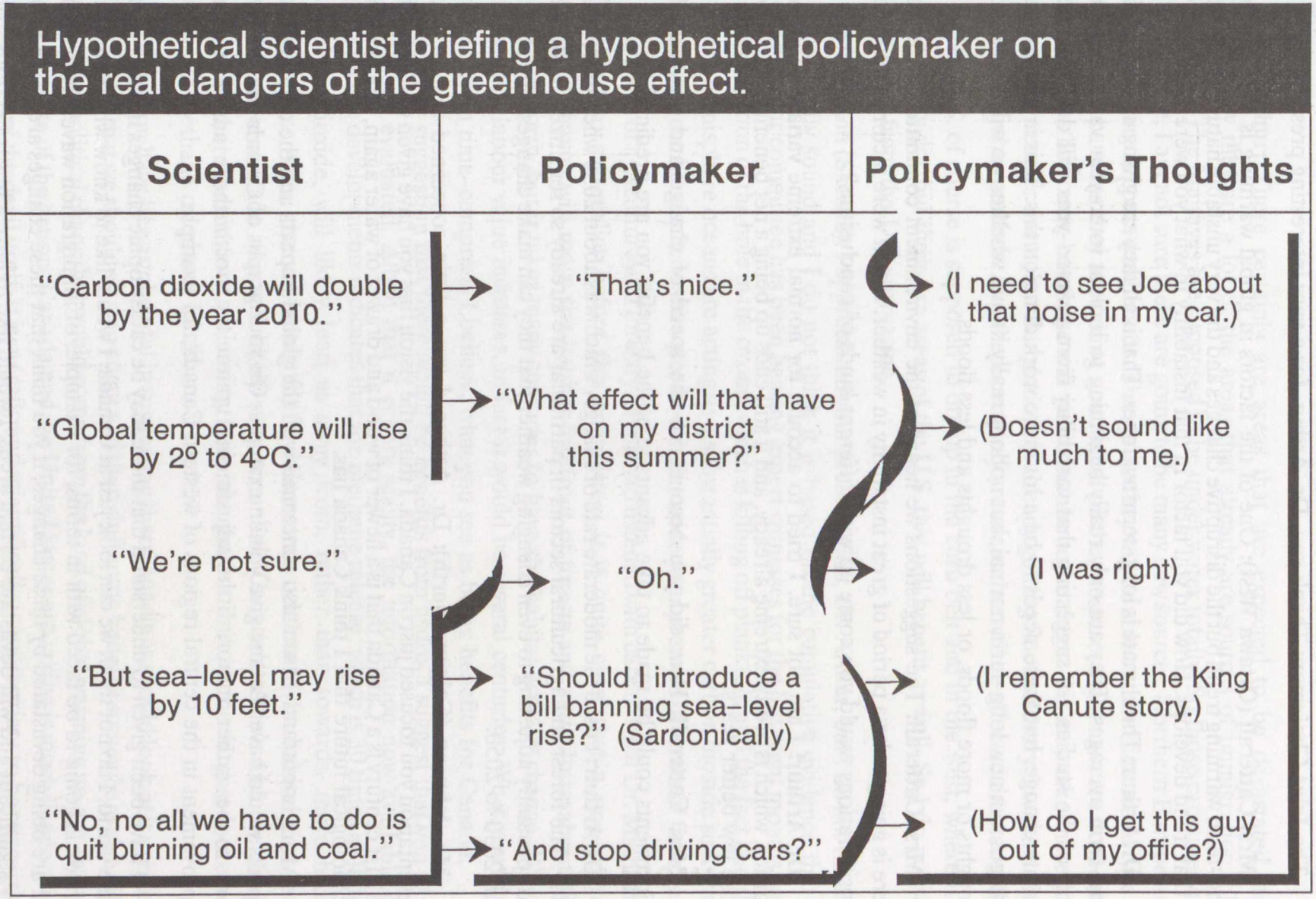
Model Flows


Climate Scenarios
Weather
Seeding Date / Time Scale
Soil Moisture
Crop Yield
Crop Selection
Sectoral Effects


Hypothetical scientist briefing a hypothetical policymaker on the real dangers of the greenhouse effect.
Scientist
Policymaker
Policymaker's Thoughts
"Carbon dioxide will double by the year 2010."
"That's nice."
(I need to see Joe about that noise in my car.)
"Global temperature will rise by 2° to 4°C."
"What effect will that have on my district this summer?"
(Doesn't sound like much to me.)
"We're not sure."
"Oh."
(I was right)
"But sea-level may rise by 10 feet."
"Should I introduce a bill banning sea-level rise?" (Sardonically)
(I remember the King Canute story.)
"No, no all we have to do is quit burning oil and coal."
"And stop driving cars?"
(How do I get this guy out of my office?)

The Joint Chairman: Thank you, Dr. Arthur, for a very interesting presentation.

Mrs. Catterall (Ottawa West): One of the factors in global warming is not only the long-term warming trend but the disruptive changes and the very unstable nature of climate as that trend develops. How did you factor in that instability in what you were looking at?

Dr. Arthur: The climate is long-term averages. That is all they are giving us, changes in long-term averages. They are only really beginning to look at inter-year variability and most of the studies are suggesting that variability from year-to-year will decline under climate change, but there needs to be a lot more work done on this. This is just gradual changes to a new long-term normal, but nobody really knows whether we will have more droughts or more floods, or less droughts and less floods.

Mrs. Catterall: The suggestions we heard at the environment committee were that there is going to be a period of great instability in weather. If that were factored into your considerations would you come up with different kinds of conclusions?

Dr. Arthur: I am not sure. I tried to account for normal extreme variability in the prairies, which is pretty extreme already, and it still ends up being a net benefit just to have those few better years.

Mrs. Catterall: How did you account for the speed of change and how rapidly adjustments could be made to take advantage of the benefits you are predicting?

Dr. Arthur: I used the moderate rate of change, which was about 2050 when we did this study. The forest and agricultural sectors in particular are already so sensitized to climate and constantly adjusting to even changing weather that they can make changes much faster than 2030 to 2050.

Mr. Johnson (Calgary North): Dr. Arthur, I was a little concerned that in your presentation you focused just on Canada. I think the vision that you have given of Canada in the 21st century is a Canada that is a hewer of wood and drawer of water again, ignoring the technological future that I think Canada has.

More importantly, I am also concerned with the global impacts and the degree those impacts would have. Let me give you an example. On your graphs of Canada the changes seem to be rather minor, little adjustments up on the north there and a modest improvement in the central regions of western Canada, for example.

I have been given to understand that there may be catastrophic changes in other parts of the world. I do not think we can look just at Canada. I would like to know what you think Canada is going to be faced with in terms, for example, of immigration waves from areas that are being devastated by these changes, if you think that these changes are going to be very significant and will devastate certain areas. I would like to have a few reflections from you on Canada in the global context, if you do not mind.

.1020

Dr. Arthur: There certainly are areas that are expected to be devastated, and unfortunately they are a lot of the areas that already are sources of immigration, like Bangladesh. The Maldives are supposed to be under water totally. So those pressures are already there. I am not sure there are going to be many new sources. Northern Europe and the U.S.S.R. are supposed to benefit as we do, so they will be able to take the normal type of immigration patterns they are taking now. Most of the pressures right now are economic ones, not weather ones, but those will just continue to be there. We may take more just because of a weather event, but Bangladesh is already getting flooded every few years. So I do not see big changes there, but there certainly are areas that will be affected dramatically.

The U.S. of course is supposed to dry up in the corn belt and in the west, where it is already pretty dry, but there are areas of the U.S. that will benefit as well. So I do not see immigration from the U.S. increasing.

Mr. Fulton (Skeena): I appreciated your presentation, Dr. Arthur, but I do not think it is scientifically sound and I do not think it is based on the cumulative evidence that is available. Our committee has been hearing expert witnesses for the last eight months, and the combination of the hole in the ozone, which is killing off plankton, and the fact that the northern hemisphere oceans are acting as a substantially greater carbon dioxide sink than are the southern hemisphere saltwater bodies set aside your premise in terms of fisheries.

In terms of agriculture and forestry, if you had listened with care to what Dr. Maini and others had to say earlier before this committee, it is quite clear that a one-degree centigrade change will move the habitat forefront of forests and agriculture about 100 kilometres north, but it takes many centuries to have the habitat actually change. Where you forecast labour value increases, in fact it would be several centuries. What you have done is try to time-compress, I believe, what you see as being benefits for Canada.

On your suggestion that there would be benefits from hydro, I suggest that you have not properly evaluated. Albeit that it is very scanty, the information now available on hydroelectric developments indicates that the methane release, which is 30 times as lethal as carbon dioxide, will likely lead us away from, rather than towards, more hydro developments. Also, the advance of 100 kilometres northward in habitat for each one-degree centigrade rise will likely start to unlink Canada's, Asia's and the Soviet Union's northern permafrost, releasing from the tundra one of the largest locked-in sources of methane on planet Earth.

I think you have been unhelpful in suggesting that Canadians should look at it as being a benefit and that we should start to adapt and then shift some benefits somewhere else. The kinds of geopolitical chaos that would come from the kind of global warming we are already facing because of the actions Canada and the United States are taking is much like looking into the eyes of the devil itself. It is morally and scientifically inappropriate to be suggesting that adaptation and benefit analysis is the approach to take. I would hope to hear from you

whether or not you have taken into account the implications of biofeedback, whether or not you have looked at the implications of the combination of the growing hole in the ozone along with global warming, because the combination of these effects is truly tragic, not just for Canada but for the globe.

Dr. Arthur: There is a lot to answer there. These are not all my own studies, of course. I have collected all the studies available on impacts as they come out, and this is the summary of all those results. I have not tried to bias them; I have just selected them and summarized them for you here. They are all based on just climate change, not on the ozone hole. That is the weakness of impact studies: it is very difficult to account for everything. So the initial impact studies have focused on particular scenarios, without being able to account for all the other effects.

.1025

I definitely agree with protecting the ozone layer. I see that as a different issue, not the same as climate change. I am anti-pollution. I think there are lots of good reasons to stop polluting, and the greenhouse effect is one of them. Ozone is probably much more important.

I think it is more a scientific issue than a moral one. I am not trying to say that we should keep polluting to benefit Canada. The world cannot handle big changes like this. I think we need to slow down change. I think we have to pull back. I think we have to reduce carbon dioxide emissions, and there are a lot of negative effects from massive hydro developments. But impact studies are there to look at the positives and the negatives, and there are going to be some positives. I know it sounds immoral to say anybody benefits, but if you look at impact studies, somebody benefits.

Mr. Porter (Medicine Hat): I was interested in hearing your views relating to agriculture. It is somewhat of a mixed blessing listening to you. I have been in agriculture all of my life, so seeing it in a positive light is somewhat heartening. On the other hand, my living made in agriculture is in the extreme part of southern Alberta, which you have indicated may practically disappear.

Do you really feel that the benefits in those areas that will be expanded are going to be enough to offset the significant losses that we see in other parts of Canada? I think we have to look at everything: crop conditions, new crops, soil management, and water conservation. There is a great variety of things that enter into this picture. How did you arrive at your decision that there would be a net benefit to agriculture?

Dr. Arthur: The benefits will not occur so much in the northern areas. They would be marginal, as the northern areas are now, providing forages and things like that. The southern areas, though, will be able to grow more valuable crops. Manitoba will be able to grow soybeans, for instance, instead of just wheat and barley and canola. Also, there will be negative effects on other agricultural areas such as the U.S., which is expected to increase prices. These are from a lot of studies coming from around the world, trying to look at

aggregate world effects on agriculture. Prices are expected to increase because major areas are going to lose crops to areas that are not currently growing them.

Ms Hunter (Saanich—Gulf Islands): What we have seen in your presentation is the danger of taking one portion and extrapolating from that. I am giving you the benefit of the doubt: that was not your intention. Making impact studies the determinant of policy is not the way you are expecting us to go. What you have demonstrated here is the repudiation of the global consciousness that has been going on. I presume that you are in agreement that this consciousness is a good dynamic to continue.

All of the benefits you have cited presume that everything else is going to be remain static, that the rest of the world is not going to be in chaos, that the grain belt is going to be able to go farther north, and that we are going to be able to continue to go grow grain while the environmental refugees are knocking on our doors. What we have to do as politicians is recognize that it is never the case when one dynamic urges another dynamic. What we may in fact be looking at is global chaos if we do not take very firm, strong stands against pollution. None of us is going to be the ultimate beneficiary, because we are not an island, we are a globe, and we have to think in those terms.

.1030

I am now going to give you the opportunity to switch from your national focus of beneficiaries and give you the opportunity to look at it as a global perspective.

Dr. Arthur: Unfortunately, the beneficiary effects increase as you look at the global perspective. But this all presumes that the change happens slowly enough. Again, I was looking at a moderate rate of change, and the latest models are suggesting even a slower rate of change. You are right, a very fast rate of change would produce absolute chaos. But if this happens over 100 years, then adjustments are easier to make than they are—

Ms Hunter: I will ask one little supplementary here. Why would you think it would be a slow rate of change, at the rate at which we are polluting?

Dr. Arthur: As you saw in the speeches yesterday, they have not yet seen much of the climate change that the models predict. The models are predicting twice the change we are actually seeing. It suggests that a number of natural effects are offsetting man's additions to the atmosphere. The oceans are absorbing carbon dioxide and there is an increase in cloud cover. All these things are buffering the effect. That is why the new models are predicting a much slower rate of increase, not because of any action man is taking but because of the ability of the earth to buffer these effects.

Mr. Proud (Hillsborough): It is a very interesting forum. I have a short question regarding the labour market. The labour force and the labour field as we know it are concentrated in heavy industry and now more than ever in the service sector. With the changes that everyone sees coming in the next number of years—be they short-term or long-term—what effect do you see this having on these traditional areas of work we have in Canada? And how long will it be before we see them?

Dr. Arthur: I am not sure I understand your question.

Mr. Proud: The heavy industry, the auto industry, the mining industry, all of this, is where the traditional work force—

Dr. Arthur: How will those be affected?

Mr. Proud: Yes. How will that be changed, and how long are we looking at for the change to take place?

Dr. Arthur: I have not seen any research on any but the resource industries. All of the impact studies have been done on industries that are directly affected by weather. Nobody that I know of has tried to extrapolate that beyond the resource-based industries.

The Joint Chairman: Our second speaker is Mr. David Bates, Professor Emeritus of Medicine in British Columbia. He is a distinguished scientist. He has authored over 200 articles and two books on respiratory diseases and the health effects of air pollution. Dr. Bates.

Dr. David V. Bates (Professor Emeritus of Medicine, Department of Health Care and Epidemiology, University of British Columbia): Thank you very much, Mr. Chairman. It is a great privilege to have an opportunity to address the committee.

.1035

Although there is a majority consensus among scientists that global climatic change induced by human activity is already occurring, there are considerable differences in estimates of the likely magnitude of these changes in the future. As I am not an atmospheric scientist, I have no view as to which of those scenarios is most likely.

If we look at the most extreme of them, it is obvious that the magnitude of the adaptive social and economic changes that will be imposed on us is so great that immediate health concerns would be, relatively speaking, a minor part of the transformation that would occur. With less extreme changes, some adverse health effects would be predictable. I do not intend to describe those in detail because I want to suggest to you that there is a more important immediate agenda for us to consider.

The philosopher Kierkegaard remarked, "We live by looking forward, but we learn by looking backward." In our present situation we might conclude that we will only survive if we are prepared to look forward.

Let me remind you of where we have been. The 1950s were a decade in which severe local pollution problems became obvious. The disaster in London in December of 1952, with a documented mortality of 4,000 excess deaths, finally triggered action to reduce the pea-soup fogs that had been a joke since the days of Charles Dickens. Pittsburgh had already taken action to reduce gross coal-burning pollution, and many cities followed suit.

The decade of the 1960s was characterized by recognition of photochemical oxidant pollution in Los Angeles and by the building of taller smokestacks for major industrial

sources. The first efforts to reduce automobile pollution emissions also began. This decade also saw significant work on the impact of pollution on human health other than to cause an immediate increase of deaths.

The 1970s were a decade of complacency. Simple measures like prohibition of open coal burning had led to a great reduction in visible smoke pollution and local problems were significantly reduced. But emissions of oxides of nitrogen and sulphur dioxide were still climbing, although a temporary reduction occurred with the oil crisis of 1973.

This is an interesting slide showing the build-up of emissions of sulphur dioxide and nitrous oxide in the United States between 1950 and 1980. These were decades in which emissions were climbing, and you can see the regional distribution of those emissions very nicely on this plot.

It was in the 1980s that we learned that our emissions were having a global impact. The first new perception was that many pollutants were travelling long distances and having an impact hundreds of miles away from their origin. This was particularly true of photochemically produced ozone and acid aerosols, which were the precursors of acid rain. This problem, first recognized in Europe, was documented to be occurring also in North America. The second new perception was that man-made chemicals were destroying ozone in the stratosphere and that atmospheric carbon dioxide was increasing.

During this decade there was increasing evidence of adverse impacts on human health from man-made emissions. Most of us have taken these signs as a warning that the global atmosphere can no longer absorb the pollutants we have been putting into it.

This remarkable satellite picture, taken in the mid-1980s from a satellite circling the earth, shows North America, with the Canadian lakes up at the top and Florida just at the bottom. These white bands are cloud bands, but this haze stretching out into the Atlantic is man-made sulphates. In other words, that is the summer haze over the northeast of America, which is a mixture of ozone and sulphuric and nitric acids and neutralized sulphates.

This problem, which we have been very much concerned with and still are, is extremely complex—much more complex than the simple idea of acid rain would indicate. If you just talk about acid rain, you look at one little part of what is happening here. The reality is that we have nitrogen dioxide forming ozone, which through a complex series of reactions accelerates the formation of sulphuric acid and nitric acid from sulphur dioxide and nitrous oxide. This tends to go around in a circle.

.1040

The importance of this was shown in studies I had the honour to present here some years ago in southern Ontario, studying hospital admissions from Windsor to Peterborough, in which I showed that hospital admissions for acute respiratory disease in the summer were related to levels of sulphate and ozone.

Since then we have had remarkable new evidence that is the reverse of reassuring. This is data from a study in Dunville, Ontario, at a children's summer camp in 1986, which documented on July 25 a sudden spike of pure sulphuric acid. This is pure sulphuric acid aerosol. This is neutralized sulphate. But here is sulphuric acid in pure form as an aerosol. Since then we have learned that this kind of acid pollution is common in the northeast.

The most recent data I have from a study I am concerned with show for various places—Kentucky, Pennsylvania, Tennessee, Connecticut, and Dunville, Ontario—the ratio of sulphuric acid to nitric in the total acidity pattern in the summer. You will notice that Dunville is rather distinctive, in that nitric acid is a bigger component of the acidity than sulphuric acid. This is a matter that should cause major concern with the emitters of nitrous oxide, mainly the coal-burning utilities and the automobile component.

I want to spend the few minutes available to me considering first what is going to happen to that change with any global warming, and secondly whether we are in a good position to meet these challenges. There are many reasons for pessimism. First, the main actors in relation to possible fuel emissions are resistant to change.

I was at an air pollution meeting in Los Angeles four weeks ago and heard an American speaker describing new Japanese technology applied to large coal-burning utilities that results in reductions in carbon dioxide emissions by 66%, in sulphur dioxide emissions by 92%, and in nitrous oxide emissions by 87%. His calculations showed that if these were applied in the United States the increases in the cost of electricity in the year 2000 would be only 12% above 1990 levels, and by the year 2010 only 4% higher than 1990 values. If we are to be as radical as that, and we may need to be, I am sure the changes will have to be forced on that industry by statutory legislation.

Secondly, at the same air pollution meeting I heard Dr. Fishman from NASA describe new data from satellite monitoring that indicate beyond question that a considerable general increase in background tropospheric ozone has occurred in the northern hemisphere over the past 30 years. He believes that this is the result of oxide and nitrogen emissions, and he concludes the present study suggests that future global scale tropospheric ozone increases can only be curbed if the emissions of nitrogen oxides are reduced.

He furthermore calculated that the increase in tropospheric ozone, that is at ground level, was responsible now for as much warming of the earth's climate as the increase in carbon dioxide. These findings are about to be published in a book called *Global Alert*.

So far Environment Canada has treated nitrous oxide emission reduction only in terms of reducing tropospheric ozone to levels below the present Canadian standard, but it must now be addressed in terms of global reduction.

There are additional reasons for concern about photochemical oxygen pollution. At present levels it is reducing agricultural productivity even in the Fraser Valley in British Columbia, let alone in large regions of the northeast United States. It is also adversely affecting human health. The point is that the depletion of ozone in the stratosphere

increases UV intensity at the surface, and this accelerates the formation of ozone. Any global warming for any reason also accelerates ozone formation. So what we have had a minor experience of in 1988 with the high ozone levels across the northeast United States and Canada is going to be the scenario of even minor degrees of global warming. These secondary effects are likely to have more important implications for human health than would global warming per se.

.1045

Third, there are reasons for concluding that we need to change our decision-making processes. I have noted that the leaders of the governments of Canada, Britain and the United States, when first elected, all minimized environmental issues. I am concerned at how we bring countervailing influences to bear on our political leaders.

Fourth, we have a problem in Canada in ensuring that policy-makers in Environment Canada are fully apprised of the adverse health effects of common pollutants. Health and Welfare Canada was a johnny-come-lately in relation to acid rain. It has minimal manpower to devote to these problems, for some reason or other, and therefore very little expertise. At the same time health data was being presented before Senator Mitchell's committee of the U.S. Senate on adverse health effects from the precursors of acid rain, I was receiving phone calls from Canadian consulates in the United States telling me that the official Ottawa position was that there were no such effects. The danger is that the global problems are once again treated by a process of more or less private negotiation between government and industry. This will result only in implementing those measures that can most easily be adopted, and one cannot have confidence that major long-term issues will be addressed.

Finally, we need to look at the linkages between the scientific community in Canada and government decision-making processes. Here we have major difficulties. I note, for instance, that the Associate Committee on Air Pollutants, which used to run under the general direction of the National Research Council, has been disbanded. The Canadian Clean Air Act has now been pre-empted by the Canadian Environmental Protection Act.

The press release that accompanied this change made no mention of the criteria pollutants, such as oxides of nitrogen, sulphur dioxide or ozone, but instead mentioned asbestos, vinyl chloride and lead. I am well aware of the hazards of those materials, all three of which are included in a report I authored for the Science Council of Canada 12 years ago.

The Canadian Environmental Protection Act will come to be regarded as a lost opportunity. It should have commented on the need for major emission controls and established the mechanisms whereby these could be implemented across provincial jurisdictions. The Royal Society of Canada, of which I have the honour to be a fellow, seems only to be called upon by government when there are internal divisions of opinion in government departments. I therefore urge you to review our decision-making processes in

Canada, asking the question of whether we are now in a position to mobilize our leading scientists effectively in relation to the coming questions and how this should be done.

The apparent dislike of government for independent scientific input bodes ill for the future. I am reminded of the words of Mr. Litvinov, the Soviet Ambassador to London to Lord Halifax in 1938. He quoted a Russian proverb as follows: "Your actions speak so loudly that I cannot hear what you are saying". The problems we have created for ourselves cannot be wished away by a stepped-up public relations program. Without such new mechanisms in place, it is my belief that we will prove unequal to the coming challenges. The scientific data we have acquired in the last decade should, at the very least, warn us to put our house in order if we are not to be too late. Thank you very much.

.1050

Mr. Caccia (Davenport): Thank you for your excellent presentation, Dr. Bates. Would it be fair to say that when we neglect to control pollution at standards considered medically safe, we in essence allow our industrial activities, utilities activities, our travelling transportation activities to become eventually a burden to the public purse by way of health care that has to be taken care of subsequently?

Dr. Bates: I think this is a fair statement, with the proviso that it is extremely difficult to put a dollar sign on the health care cost.

I draw your attention to a very important report to the U.S. Congress of February 1989 that pointed out the impossibility of deciding on air pollution control measures on the basis of cost-benefit dollar economics. The reason is that—

Mr. Caccia: Can I interrupt you here and ask you what happened to your excellent study in Ontario on admission to hospitals caused by air pollution in Hamilton and other Ontario centres?

Dr. Bates: I am quite sure there is already a major health cost attached to present levels of pollution in southern Ontario. I find it hard to know whether to pick outer limits or inner limits. The anxiety now is that the sulphuric acid component I have shown you—sulphuric acid aerosol is not measured routinely in Ontario, we only have a few scattered measurements—is very likely to be the major factor in influencing hospital admissions. It is also likely to be a major factor in producing respiratory disease in children.

Mr. Caccia: Do you agree with the western governments' present procedure whereby they are cutting sulphur dioxide pollution by 50%? Do you consider that adequate from a public health point of view?

Dr. Bates: I think we will also have to cut nitrous oxide emissions by about the same amount to reduce the ozone formed from nitrous oxide.

Mr. Caccia: Are you satisfied with the present standards?

Dr. Bates: No.

Mr. Wilbee (Delta): Welcome, Dr. Bates. I appreciate your presentation.

We have been hearing a lot about the effect on agriculture and farming, our freshwater lakes and so on. As a physician, I was wondering if you could just outline to the committee the direct effects on human health of pollution. We recognize that it affects many different areas. You mentioned Dickens and old chimney-sweeps and so on, but what are the modern implications of pollution?

Dr. Bates: I think the answer to this is that we are fairly sure acute lung disease is affected. This probably includes acute bronchitis, it may include acute pneumonia, and it certainly includes a worsening of asthma.

Asthma affects between 5% and 7% of the population. If you take children, again, as a susceptible group because they run about out of doors, then the number of susceptible children is pretty nearly 25% of the population. So we are looking at a very large number of people who are particularly susceptible to things like sulphuric acid aerosol.

In three weeks' time there will be a press conference in Boston when a group of Canadian and American chest physicians are publicizing their major concern about the health effects of sulphuric acid aerosol as we now know it exists. The impact is mainly on children and also on anybody who is active out of doors in the summer. So we are not looking at the over-60s, who are mostly indoors, we are looking at active people in age groups who are out of doors in the summer who get a major dose of these particular pollutants at this point of time.

The reason for understanding this is that any global warming scenario you look at will worsen it. By increasing the ultraviolet light on the earth's surface and by increasing global warming you are going to have this problem simply made much worse. Therefore, the controls on it by nitrous oxide emissions and sulphur dioxide emissions particularly, even on a local basis, become imperative.

.1055

Mr. Fulton: Thank you, Dr. Bates. Looking at global warming and the synergistic effects of sulphurous oxide and nitrous oxide and the hole in the ozone, I take it from your evidence, is extremely important. I think we know now in North America that the losses to agriculture are in terms of billions from ozone now and are likely going to increase rapidly. We know that acid precipitation is causing billions of dollars in loss to our forests per year in Canada and thousands of lakes at a time. As you have well pointed out, the implications for human health are dire and our need for much more stringent national standards, targets and timetables is rapidly increasing.

Could you spend a moment in going back to the synergistic implications of all of this? We continue to hear about it in bits and pieces. As the hole in the ozone gets worse and as global warming increases to the point where we see the reduction in stratospheric ozone and the dramatic increase in near ground ozone, the implications for forestry, for agriculture and for human health become increasingly dire.

Among the studies released last year in the United States, one indicated health costs in the United States were perhaps as high as $50 billion a year from air pollution and another indicated it was perhaps several hundred billion per year. There are no comparable long-term epidemiological studies in Canada particularly tying the synergistic impacts of these three terrifying air phenomena together. Perhaps you could spend a moment on why we should focus on the synergy rather than on one piece at a time.

Dr. Bates: There are answers at several different levels. Let us take the simplest. If you take an asthmatic child and expose him or her to a very low level of ozone, well below the Canadian standard, and then the next day expose him or her to a very low level of sulphuric acid, not enough in itself to do anything, the fact that they got ozone the day before means that they have a marked response to the sulphuric acid the next day. This is exactly what is happening in the northeast. You have to envision children going out on a Tuesday afternoon, which may be a high ozone day, and on the next day hitting a peak of acidity, just like the one I showed you in Dunnville.

In other words, at the first level, particularly children are sensitive to these pollutants in sequence. It is not enough just to look at each one separately. If they get ozone the day before, the sulphur dioxide and sulphuric acid is much more damaging a day later. This is the level-one answer to your question.

The level-two answer is that they are very closely interrelated chemically. It is thought now that the ozone is what is driving the rapid formation of sulphuric acid from sulphur dioxide. Sulphur dioxide is not anything near as harmful as sulphuric acid for the same equivalent weight of sulphur. So ozone is having an effect chemically in worsening the situation you are into as a result of sulphur dioxide. They interact chemically in that way.

Thirdly, on a final level, the plant physiologists have been telling us for at least 20 years that plants are very sensitive to these alternating pollutants, alternating acidity and ozone, in other words. The data we now have on children are exactly like the data the plant people have been telling us about the effect on plant growth. When you look at the situation now even in our Fraser Valley, which does not get any acidity—it just gets ozone—the effect on growth rate is detectable to the extent of $2 million or $3 million a year in reduced productivity.

In California the economic costs in reduced productivity are enormous. There is no visible damage, but a Los Angeles meeting I was at documented that the production of grapes in the Napa Valley is cut 15% to 20% by the ozone drifting up from San Francisco. This has reduced productivity. It is not damage that you can photograph on a leaf.

Even forgetting our global contributions, even if you were to put those on one side, which I do not think you should do, major reductions of the kind now possible with modern technology, as I indicated, 60% in nitrous oxide emissions, 80% in carbon dioxide emissions, these things are now technically within reach. The question is how to get Canada to implement them.

Mr. Fulton: Thank you, Doctor.

Mr. McCurdy (Windsor—St. Clair): Mr. Fulton's question went over much the same ground that my question would have gone over. My question is directed towards the question of the ozone hole.

After having had a conversation with you last night, Dr. Bates, I wanted to hear what you would have to say about what level of production and use of CFC would be an appropriate target for ozone atmospheric levels, as compared to what is being pursued now.

Dr. Bates: I would give the same answer Dr. McLaren gave. We know enough about CFCs to say that an immediate international ban is imperative. There cannot be any other answer than the one he gave yesterday; that is, these are so damaging that we have to work towards getting international agreement that they go out totally.

A lot here depends I think on the position the west takes in regard to developing countries. We were told yesterday, you will remember, that China did not want to say that it would not have CFCs in its refrigerators, and this kind of thing. We are going to have the same issue in eastern Europe, which has the worst coal-burning pollution in the world. If you are going to try to restructure Polish industry, if you are in the World Bank, then you should insist that they install the best contemporary technology. Aid or development money should be conditioned on the absolutely best contemporary technology. If anyone is thinking of helping China make refrigerators, then they should be made to use the CFC alternatives right there.

What I am saying is that this is the way this has to apply. The Third World might well object that this is discriminatory, and it is, but it is ultimately in the interests of everybody that this is the route that is taken.

You can produce a coal-burning fossil fuel plant now virtually pollution-free. It ends up with metallic sulphur, calcium carbonate—which is limestone—and practically no nitrous oxide emissions. That is modern Japanese technology. If we are going to revolutionize the Polish coal industry, that is the kind of thing we have to build into the rejuvenation of that industry.

The Joint Chairman: Dr. Bates, thank you. It was very interesting.

Our third speaker is Mr. David Runnalls who is Associate Director of the Environment and Sustainable Development Program at the Institute for Research on Public Policy. He is the author of several papers and articles on sustainable development and he has served as a consultant to a number of international bodies, including the U.N. Environmental Programme. He will sum up the opinions of those experts we have heard in the last few days. He will also comment on environmental issues.

Following a question period, may I remind you that our next witness will be the Minister of the Environment, the Honorable Lucien Bouchard.

Mr. Runnalls.

Mr. David Runnalls (Associate Director, Environment and Sustainable Development Program, Institute for Research on Public Policy): Thank you, Mr. Chairman.

I feel very privileged to be here. I was asked, as some of you know, by the chairman of the environment committee to sum up this meeting and to offer some of my own observations. As a result, I have been present I think throughout all of your deliberations, one of the few who have, and I have found it an extraordinarily rich experience. I do not think any other legislature in the world has delved into these issues in as much detail as you have in the last couple of days.

I would like to begin my presentation by congratulating the organizers for bringing this sort of event together.

.1105

I was personally very intrigued by two remarks made by Doug Miller in the course of a fascinating presentation on public attitudes and public opinion. First, he said the environment was the rallying point for the formation of a new social conscience in this country, and it is therefore not just another run-of-the mill political issue.

Second, he demonstrated that although Canadians are very concerned about atmospheric issues as a whole, few understand global warming and its causes. In fact, many Canadians seem to believe ozone depletion and global warming are roughly the same thing. This is worrisome but understandable, for as we heard from Dr. Schneider, climate change is an enormously complex and difficult problem.

It rather reminds me of a wonderful remark once made by Britain's greatest Foreign Secretary, Ernest Bevin. Bevin, although much brighter, had the same sort of difficulties with the English language as Dwight Eisenhower. Once, when faced with an intractable foreign policy question in the House, he described it as "a Pandora's box full of Trojan horses". I think that is rather like climate change. This forum, and others like it, are therefore rather critical to forming a much clearer public impression of the issue.

Mr. Chairman, when taking on this assignment I was asked by your colleague David MacDonald to do three things. One was to provide a kind of summary of what I felt to be the most important points made in the previous sessions, an extraordinarily difficult job for sessions as rich as these. Second was to comment on what I felt was missing from the proceedings. Third was to add my own views to those of the others. What follows therefore will be a combination of plagiarism, sour grapes, and my own pig-headedness.

The first issue, on what, or in some cases who, was missing, I should begin by saying it really is impossible to cover all the relevant issues in such a short time. Perhaps one or two

of the following, however, would provide a subject for future hearings of one or two committees, or indeed the subject for another forum in the future.

I must say that like one of the previous speakers, I was disappointed not to see either the finance or the foreign affairs committee here, although I realize the latter had an unavoidable engagement. In fact, I believe they are now in Moscow at this very moment.

As you can see from the testimony, climate change and the responses to it are critical to the future of the Canadian economy and to Canada's place in the world trading system. Most of the solutions proposed have major consequences for the tax system and could profoundly affect those industries, such as forestry and energy, which have traditionally provided much of our export income and employment for large numbers of people. I think it is therefore a subject one will discover your colleagues in the finance committee will have to deal with in the fairly near future.

Climate change is not just an environmental issue. It is also the quintessential global issue. As Jim MacNeill and others have pointed out, global warming may well dominate the foreign policy agenda throughout much of the rest of this century. The coming round of negotiations over strengthening the Montreal Protocol, the World Climate Conference, and the 1992 conference in Brazil will be critical to the prospects of achieving one or a series of global bargains between the north and the south on these issues.

What have we learned, or what have I learned, from listening in the last day and a half? The first is that climate change is real and the climate scientists agree on the essentials of it. I thought Dr. Schneider's remarks were enormously helpful in isolating for a layman like myself where the real scientific uncertainties lie. I also found helpful his advice to us that we are experimenting not with a laboratory but with our own planet, and if we wait for absolute certainty to emerge from more scientific research it could be too late.

Despite the fact that Mr. Bush has resorted to the old American acid rain ruse that much more research is needed before action can be taken, it is clear even from the carefully stage-managed White House conference last week that the majority of European governments disagree with this approach, as neatly summarized by *The New York Times* in its headline, "More Research, Says the President; Action, Say the Visitors".

It is also clear the members of the prestigious Intergovernmental Panel on Climate Change, led by the Swedish climatologist Dr. Bert Bohlin, agree with the general lines of the analysis presented by Dr. Schneider yesterday. The IPCC is the expert body that has been designated by the international community to produce some form of scientific consensus on the issues. I am told by members of IPCC that its final report, which will come out later this year, will not be much different from the sorts of remarks you heard from Dr. Schneider yesterday morning.

.1110

This is not to say that more research is not needed. After all, I do come from the Institute for Research on Public Policy. We do need to know far more about the effects of

climate change on the fragile ecosystems of the Arctic and vice versa. As Dr. Schneider pointed out, methane is by far the most lethal of all the greenhouse gases and much of the world's methane is locked up in the arctic tundra. What will happen when rising temperatures begin to unlock that gas?

We heard yesterday from Dr. Boulva that much more needs to be done on the effects of climate change on the oceans and vice versa. These interactions are quite complex. More work needs to be done and more money spent—I hate to tell you—on the famous general circulation models. These are the Cadillacs of the climate change business. I suppose in these days of the decline of the North American automobile industry, these are the Mercedes-Benzes of the climate change business. These are the models to which Dr. Schneider referred. Very few countries in the world can do this sort of modelling, and by all reports we are rather good at it. Our own atmospheric environment service scientists are in the forefront in this work and will need to maintain this position if we are to maintain our place at the global bargaining tables.

Finally, Dr. McLaren referred to the paucity of research in the human sciences. Although there is never enough money for scientific research, the physical scientists are not nearly as badly off as the social scientists. Yet here is where many, if not most, of the answers must lie, for while the climate scientists may soon be able to tell us with some certainty what will happen to rainfall patterns on the Prairies or Great Lakes water levels or whatever, who is working on the policy and social implications of that shift? We have heard reference to our own lack of knowledge in this area time and time again, Mr. Miller pointing out that most Canadians knew little, if anything, about climate change, Mr. MacNeill pointing out that while we know a great deal about subsidies for the forestry industry and the fossil fuels industry in the United States, we have no comparable data for Canada. We simply must find a way to make some breakthroughs in this area.

Dr. Arthur has just pointed out in one of her responses the real limitations of the impact models, again a form of social science research. I find it appalling that we have impact models that deal with the doubling of carbon dioxide concentration and yet take no account of the decrease in the ozone layer.

Mr. Chairman, I have spent a good deal of my life working in the non-profit research area in Britain and the United States. On returning to Canada I have been struck by the relative paucity of this sector and by the relative poverty of the few institutions in it. These public policy research institutes do much to enrich the debate on these issues in those countries. They have a credibility both with the public—and Mr. Miller has already made the case that this is the point in this country—and with policy-makers. They are the source of much of the transparency that exists in public policy-making in the United States. The American institutions are in fact the source of much of the data that your witnesses have quoted to you in the past few days.

Given the lack of public trust elucidated by Mr. Miller and the need for far more transparency in the making of Canadian policy on climate change, I would suggest, Mr. Chairman, that we need an independent institution here in Canada to perform practical policy-oriented research on climate change and energy policy. If it is of interest to you, I would be happy to explore this more in detail in the question period.

I think the third lesson we have learned from the last two or three days is that climate change is principally an issue of energy policy. The only way to achieve meaningful savings in carbon dioxide emissions in the short run is by major gains in energy efficiency and in energy conservation. We have heard that many countries think this is indeed possible and that it is sometimes possible with significant cost savings both to the industry and to the consumer. This is important, because in the not too distant future, if the climatologists are right, we will need to be looking toward an energy economy that is producing 50% to 80% less carbon dioxide.

Rather surprisingly, in the omissions category, I heard little mention of nuclear power in the discussions. Although it has massive environmental problems of its own, it is the only way we currently have of generating large amounts of electricity without producing large amounts of carbon dioxide.

.1115

I feel the nuclear option is not an important short-term solution because of its cost, its inevitable and growing siting problems, and because of the time-lags involved in constructing the stations. If we doubled the world's existing stock of nuclear power stations overnight, we would only achieve savings equivalent to 5% of the current production of carbon dioxide.

When the climate change issue first arose, and when the 20% goal of the Toronto conference was first established, there was a general feeling of hopelessness. There were cries that this could not be achieved, that we would have to stop driving cars, that we would need to de-industrialize, etc. This has since been revealed as baloney, in part because we are relearning how to do studies we first learned to do in the period following the oil shock—i.e., how to manage energy demand.

As Jim MacNeill pointed out, the post-Arab-oil-boycott period has decoupled the inevitable and intractable link we used to have between economic growth and energy growth. These studies are now beginning to be reflected in a number of national policy shifts around the world. Some of these were mentioned yesterday. Sweden, the Netherlands, Norway and Finland now have some form of emissions freeze or cut as national policy. These have been accompanied by carbon taxes, emission taxes or the like.

The Swedes, on the outset, have apparently painted themselves into an impossible corner. A number of years ago Swedes voted to dismantle the country's nuclear power stations. They are wary of developing their few remaining hydro sites because these developments will result in the disappearance of the last of Sweden's wild rivers. And their

new policy on carbon dioxide emissions would seem to preclude major expansion of their fossil fuel base. One should add to this equation the fact that the Swedes have already achieved one of the best records for increasing energy efficiency in the world, and must be bumping up against some of the technological limits. Yet the Swedish government and the Swedish electricity industry have just completed a study that demonstrates that Sweden can indeed cut its emissions of greenhouse gases, still experience satisfactory economic growth, and dismantle its nuclear power industry.

I was told by a colleague from another country that at a recent White House conference the West German environment minister announced he will lay plans before his cabinet in the next month to reduce German emissions of carbon dioxide by 25% by the year 2005. When asked what particular act of alchemy he proposed to achieve this, he produced the now rather familiar list: energy conservation, increased energy taxes, new methods of taxing automobiles on the basis of what they emit rather than how much they weigh, and greater reliance on public transport.

Gerald Leech, a former colleague of mine from my British incarnation, recently performed a similar study on British energy prospects for the prestigious Stockholm Environmental Institute. I quote:

> The broad conclusion for the U.K. is that the technical potential exists to greatly exceed a reduction of 20%, even with substantial growth in the economy and in living standards. The measures examined are not technically ambitious. They reduce consumer costs or increase the profitability of firms, often by large amounts.

I am quoting from an analysis of the study produced by the science adviser for Environment Canada. Mr. Leech concludes this strategy could reduce consumer spending on energy by 140 billion pounds—about a quarter of a trillion dollars Canadian—between the years 1990 and 2005.

As Mr. Fulton pointed out yesterday, we have produced a similar study for Canada with broadly similar results. The study was commissioned by the Ontario Ministry of Energy, on behalf of the federal and provincial Ministers of Energy, for their meeting last summer. The meeting was planned to resolve Canada's position on carbon dioxide targets in general, and the Toronto conference target in particular.

The study performed by a Toronto-based consulting firm demonstrated that Canada could achieve at least 60% of the savings toward the target, at considerable savings to the energy consumer, and that the 20% target is attainable with currently available technology. This report has since been rejected by both the federal and provincial governments. Their analyses of its faults, to my knowledge, have never been made public. The ministers have since twice refused to adopt any targets for greenhouse gas emissions.

I think you realize why Jim MacNeill made the remark, picked up by *The National* last night, that he cringes in embarrassment at international meetings where Canada is listed as a leader in this field.

Fourthly, we have learned in the last couple of days that greenhouse gas emissions and climate change are economic questions. I suppose this is patently obvious to anyone in a country where economic policy has long been dominated by the need to extract basic resources.

The solutions lie not only in improved energy policymaking, but also in the economic instruments we choose to implement that policy. A very rich bag of suggestions has emerged in the discussions since—carbon taxes, an income tax surcharge, conservation pricing for energy, the removal of subsidies for the fossil fuel industry and the forests products industry. Interesting suggestions are now beginning to arise on the whole question of tradeable emissions and tradeable pollutant rights.

We have heard that Canadians in general seem to be willing to pay more taxes, or charges of some sort, if they can be assured that the revenue from these levies will go toward environmental improvement, including, presumably, alleviating climate change. This raises the spectre—the evil spectre in the eyes of the Department of Finance and the provincial treasuries—of earmarked funds.

This issue will be resolved by either conscious policymaking or attrition. We already have a number of taxes called "environmental taxes". Ontario has one on tires. B.C. has just announced one on tires and one on car batteries. It cannot be too long before taxpayers demand to see where the revenue from these taxes has gone.

I was reading the paper in a taxi on the way here today. A *Globe and Mail* headline says: "Ontario budget to portray treasurer as white knight for the environment". Again, the whole question of taxes described as environmental taxes is coming to the fore.

Fifth and finally, Mr. Chairman, we have learned that this issue may well dominate the national security debate and the international debate for the next 10 years or so. Here there is a legitimate role for Canadian leadership.

Some months ago I wrote that the 1990s version of Pearsonian diplomacy might lead us to place less emphasis on our customary concerns of peacekeeping between and within states wracked by conventional disputes and more into the arena of new threats to national security.

Here I agree with Mr. Shevardnadze that environmental change may the biggest single threat to international security. There are good reasons for this, most of which we heard yesterday. We have some considerable comparative advantages to play here. For once, some of the nostrums of Canadian politics appear to have some force. We are the only country with access to the G-7, the Commonwealth and *la Francophonie*.

At the moment, as Jim MacNeill pointed out, the north–south politics of this issue are awful. The potential for a major north–south split is very great indeed. We have access to and a certain credibility with all the major players. Although we are a member of the "rich nations club", we have had an active diplomacy with the Third World and a respectable foreign–aid program.

It seems to me that the north–south split could come from either one or both of two apparently mutually contradictory assumptions. The first, and probably most likely, is that the Third World realizes just how much leverage this issue gives them and will demand some sort of grand bargain or many little bargains in exchange for concessions on some of the issues it regards as most important.

The first evidence of this, and the easiest one to deal with, will come in June at the next ozone negotiations in London. Canada has played before a facilitating role in these types of situations—one thinks of the north–south dialogue—and might be able to do so again. Our position on official debt, recently reiterated by the Prime Minister in the case of the Caribbean, could be of enormous help here.

The second possibility is that many developing countries continue to regard this whole thing as some form of science fiction cooked up by other peoples' scientists, mainly American, to place constraints on their own energy development. We have seen this sort of thing before, in advance of the Stockholm Conference in 1972, and the only way to deal with it is to help the policy and scientific communities in the countries themselves come to their own conclusions about the magnitude of the threat to them and their own options in the negotiation process. We have other major diplomatic assets we can deploy.

.1125

Finally, Mr. Chairman, in the end, however, no matter how many extremely competent people we send abroad to be involved in this negotiating process, I suspect that our ability to change things will be directly related to how the outside world perceives our own willingness to make serious changes at home. We are in the information age, and information about domestic policies travels much faster and farther than ever before. If you doubt this, ask David Suzuki and the other Canadian environmentalists how many questions the Brazilians asked them about British Columbia's forest management policies on their last visit to the Amazon.

Mr. Chairman, I conclude by saying that we have had a very rich session. We have had an enormous number of suggestions, only a few of which I have been able to do any kind of justice to here, about Canada's policy options in this area, about the sorts of things that might require further consideration by you and your colleagues at later meetings of one or a number of your committees. I think we have seen from a number of our speakers that the old adage of Canadian altruism is not yet dead. This is an issue that is vital to our international security and one in which we could play a constructive and very creative role. Thank you.

The Joint-Chairman: Thank you very much, Mr. Runnalls.

Mr. Johnson: I have heard in two sessions about the subsidy for the fossil fuel industry in Canada and the fact that it is not defined. Let me just say that my perception, having come out of that industry, is that there is very little subsidy there. There are programs every once in a while that feed money back in, but there is an enormous amount of royalty and tax that comes out of that industry. I am wondering if there is something I am misunderstanding here about this major subsidy to the fossil fuel industry that you could enlighten me on as to just what is the source or what are the characteristics of that subsidy.

Mr. Runnalls: I think one of the jobs we need to do at a very early stage, if we are going to do anything about sustainable development in this country, is to begin to look at a whole series of sectors and at the fiscal context within which they operate. I am not particularly criticizing either the fossil fuel industry or the forestry industry because they in fact have particular kinds of tax treatments.

Mr. Johnson: I am just trying to understand what you perceive is the major source of this tax subsidy, because I perceive that it is an industry that is paying and contributing major sources of tax.

Mr. Runnalls: It comes back to the old question of whether or not one is going to try to move in the near future to something that resembles the polluter pays principle. If in fact the costs of global warming and air pollution are as Dr. Bates and others have outlined here, then it would seem to me to argue that both the industry and energy consumers particularly need to bear higher costs to begin to pay the true costs of utilization of particular kinds of fuels. In a sense, to the extent that we are actually giving a free ride to large parts of the energy industry when it comes to air pollution, for instance, we are in fact subsidizing certain kinds of air pollution because the energy industry and the energy consumers are not paying the full costs of the utilization of that energy source, and therein lies a very substantial hidden subsidy.

Mr. Johnson: Thank you.

Mr. Caccia: Perhaps Mr. Runnalls, whose statement was extremely helpful, might want to comment on the following. The lesson of this day and a half, it seems to me, is one that in future the political and parliamentary focus should be expanded to examine global change and not just global climate change, as the title of this event is. If we stick only to climate change, we leave out some very important issues. We would leave out, as was raised by some of the speakers yesterday, population, top soil, which was partially touched upon last night; toxic contamination, species disappearance, mismanagement of natural resources, mismanagement of waste, international security, which we and others have touched, and the entire north-south debate.

.1130

My tendency would therefore be that we would be better served, in order to spur and activate this government and other governments who have been very strong with rhetoric

but rather impotent with action, to examine global change as a whole, which would of course then include, as you quite rightly put, the issue of energy, the issue behind climate change, and tackle the broadest possible front rather than the climate front alone. Would you care to comment, please?

Mr. Runnalls: I think that may be a more intellectually satisfying way to proceed, but I am just worried, having listened to the discussion of the last day and a half, that the mere subject of climate change itself is so immense, so complex and brings so many of the other issues you were raising.... For example, I do not see how you could deal with the climate change question without dealing with population, and I would be somewhat reluctant to open perhaps yet another Pandora's box inside of Ernie Bevin's other Trojan horse.

All of these problems are quite critical, but I think at some stage we begin to overload people's brain cells and we overload the capacity of the policy machine to respond.

I think appropriate responses to climate change will have to involve such things as population policy. They will have to involve things such as the use of soils and soil erosion. They certainly have to involve both deforestation and reforestation, in terms of carbon syncs.

If we begin to rethink energy policy on a fairly major scale, they are going to change the whole pattern of industrialization or at least the character of industrialization over the next 30, 40 or 50 years.

Although I am intrigued by the broader global change issues, I am just wondering if the climate change issue itself is not so broad that broadening it even more could lead to a very, very difficult set of policy dilemmas for any government. Climatic change is bad enough.

Mr. Fulton: I would like to thank David for such a good summation.

One of the things I think this committee and the viewing public have to reflect on increasingly—and it actually came out of one of Dr. Bates's comments—is that 10 years ago there was a net outflow from developed countries in foreign aid of $40 billion a year to the Third World. Very few Canadians and very few people around the world know that in 1989 that had finally not only totally reversed, but there was a $50 billion flow the other way. Developing countries are holding up the economies of the developed world.

When we are talking about CFCs and refrigerators in China, when we are talking about the expansion of non-scrubbed coal facilities, whether it is in Poland, India or China, how we get the technology to them is something we crucially have to face.

This brings me to the question I think Canadians are particularly troubled by. Whenever I have spoken about the EPA report, I have said if I were Michael Wilson, what could possibly be more popular in 1990 than saying to every man, woman and child that I have a policy that will save them $5,000, it is actual money they can put in the bank over the next 10 years, while we reduce the amount of carbon dioxide going into our atmosphere by two-thirds?

You have touched on the very important point that Germany is going to go to a 25% greenhouse gas reduction, Sweden is going to meet a similar target, and the U.K. could save a quarter of a trillion dollars Canadian by going to energy conservation and to efficiency. Can you expand a little bit on why perhaps Canada is a unique nation where we probably do have to go to an independent policy-producing unit on climatology and energy? Beacuse while we have had people in Washington arguing for a national acid rain accord and clean air act for the United States, only seven out of ten Canadian provinces are.

.1135

All other countries seem to be moving towards some realistic goals in greenhouse gas reduction, yet our own Minister of Energy is clearly held hostage. I do not say this for partisan reasons. He is being held hostage by the mandarins of the fossil fuel sector, because to not move.... We have a $4 billion carbon tax now. That is what the excise tax is on fuel in Canada right now. No one wants to talk about it in Alberta. No one wants to talk about it in Halifax. But we have a very important and vital responsibility: we are among the dirtiest per capita in the world and we are doing nothing about it.

I would like to hear you expand a little bit on why perhaps, in this period of intense conflict of interest, the Minister of Environment is doing nothing, the Minister of Energy in fact is going the other way. Since the Toronto conference we have, on a day-by-day basis, been putting more greenhouse gas into the atmosphere rather than less. So I would like to hear your views on a rather convoluted and complex question.

Mr. Runnalls: I am tempted to ask you what your views are. You are the people who are setting policy.

This is not an easy question. I think there are perhaps three aspects to this whole question of looking at demand-side studies. In the period immediately after the Arab oil boycott these things became very much in vogue. There was a lot of talk about "changing the paradigm", in the electricity industry particularly. The electricity industry historically was set up to provide supply. It is staffed by people who are good at that. It is staffed by good engineers. It is staffed by very good designers. We have some of the best ones in Canada.

As you probably know, any large organization then begins to acquire a certain kind of corporate culture, and the good utilities have one. Hydro-Québec is viewed in Quebec as being one of the major reasons for the economic renaissance of Quebec. These are almost, sort of, non-political considerations.

Taking the electric utilities and beginning to get them to understand that what they are really delivering is a service, and not necessarily *x* watts of electricity, is something that will take a while. In those countries where it has happened—Hélène Lajambe referred to New England and California yesterday—it has been because they have bumped up against constraints that have forced them to that.

The Massachusetts utilities are now faced with increasing demand, with no capacity to rely on nuclear power because of the political problems over the Seabrook nuclear reactor.

They have more acid rain problems than we do and therefore the option of building more fossil fuels plants is not open to them. So they are forced back into seeing how ingenious they can actually manage to be on conservation. In fact, they have been extremely ingenious within the constraints of the market mechanism.

So I think what we are talking about now is a major shift in the attitudes of those people who run what has traditionally been perhaps the most important industry in Canada—the energy industry—away from necessarily talking supply and talking more about how you meet the perceived needs of the Canadian public and of our foreign customers. That is not an easy shift. I think what we are seeing now are the sort of fits and starts that one goes through as one begins to make that shift.

I have no explanation for why Mr. Epp and Mr. Bouchard have apparently done what you have suggested they have done. Perhaps we can ask the minister when he comes.

All I was trying to do, by illustrating these other examples in my presentation, was to point out the fact that a number of countries have taken perfectly respectable, good, grey economic modellers and turned they loose with their energy sectors. As a result they have produced scenarios which seem to be quite plausible, some of which have actually been enacted by legislatures. They are resulting in significant energy savings, significant reductions in carbon dioxide emmissions, and actually monetary savings to the people who actually buy and use energy.

Now, I am sure Canada is different from other countries. Every country has a different energy mix. Every country has different problems of geography. Every country has different mixes of industry, and we have a very high amount of primary industry, which is very energy intensive. I still do not believe all of these other studies could be going on, yielding up the kinds of results they appear to be yielding, while Canada at the same time is at a stage where we keep saying we cannot afford to do anything about target-setting in the carbon dioxide emissions business.

.1140

One of the reasons I suggested the possibility of some sort of quasi-independent body in this area is that I sense from what Mr. Miller was saying the other day and from remarks I have had from friends of mine in western Canada, for instance, that there is very little public trust in the energy policy-making process in this country because it is not sufficiently transparent. It may in fact be excellent. It may be based on absolutely first-rate information. But it is not transparent to the public what is actually happening in terms of setting targets.

Mrs. Catterall: I think it is evident to all of us that our greatest new source of energy is not nuclear power or new coal-fired generating stations but conservation. Saturday I heard on CBC a description that the energy-efficiency savings possible in Montreal alone are equivalent to one full James Bay project or all the oil in the Middle East. I think that is where we clearly need to be focusing our energy.

In connection with that, you talked about charging the true costs for energy, which include clean-up costs, damage-avoidance costs, and development costs, which have largely been subsidized by the taxpayer. Have you considered how we regain those true costs, which have been and will be borne by the Canadian taxpayers on our exports of energy?

Mr. Runnalls: No, I have not. That is something I have done absolutely no work on and genuinely no thinking about.

Mrs. Catterall: Are you aware of anybody who has? It seems to me it is not only grossly unfair but counterproductive to be recouping true costs from Canadians, who are one-tenth of the market that we are also supplying with energy.

Mr. Runnalls: I do not disagree with that. It is an area I have really no competence in whatsoever.

Mrs. Catterall: The second question, along the same lines, is that I am reluctant to deal with punishment as opposed to incentives. Above all, I am reluctant to impose punishment when the government is not leading by example. Mr. Fulton, I say that in a totally non-partisan way.

It seems to me that as the largest employer in the country, with, including all federal agencies, over half a million employees, the government could have a great deal of money to put into environmental concerns if it were simply to make its own operation as energy efficient as possible.

I accept the idea that we already have a substantial carbon tax and it does not seem to be doing the job. So I am not sure that is the best direction to go in. I also have extreme difficulty with the government starting to provide licences to pollute, which to me is what emission permits are.

I would appreciate some of your thinking on the more positive steps that could be taken. For instance, it seems to me to make more sense to put money into energy conservation, with the resulting savings from that, than to look in the other direction.

Mr. Runnalls: Yes, I agree with that. I think there is a real danger that this whole debate can be turned into a kind of punishment of certain sectors of society for "misbehaving" in particular ways. There are plenty of incentives available in the cupboards of finance ministers to induce particular sectors of society to behave in particular ways. We do it all the time. If one of our goals is to reduce carbon dioxide emissions or encourage more efficient use of energy, there are lots of carrots that can be offered. I would suggest the carrots are much more likely to encourage the kind of technological change that needs to take place in the utility industry, for instance, than beating people over the head with a heavy stick all the time.

I am not sure I agree with your analysis of tradeable permits. There is a tendency to say yes, these things are simply licences to pollute. If what happens with the use of tradeable

permits in the United States, for instance, is what happened with airline deregulation, then it is a bad idea. I know a number of the people in the U.S. environmental community are worried about the fact that if tradeable permits become part of the Clean Air Act, or whatever, the government will then use that as an excuse not to have to regulate emissions any longer, and if you do not have a proper cap and if you do not have proper monitoring of emissions, then it becomes a licence to pollute.

.1145

If you can, however, begin to agree on targets—and we have to agree on targets anyway, no matter what we do about carbon dioxide—if we can begin to agree on targets, and we can begin to enforce compliance with the targets, I think the advantage of the tradeable emission system is that it leaves companies and industries much freer to experiment with different sorts of technologies for achieving the objectives. I think—

Mr. Caccia: But then you are stuck with that ceiling.

Mr. Runnalls: Maybe. It is not a simple issue, but I do not think it can be dismissed out of hand quite that easily. I think one of the problems with excessive and specific regulation, particularly regulation of the U.S. kind, has been that it tends implicitly to dictate a particular kind of technological response.

That may not in fact be the best use of technological skills. It may not be the best use of scientific research skills. I, for one, believe that it is certainly worth while experimenting with the tradeable emissions permits thing on one or two issues, and see how it works. I think it has a lot of arguments that commend it, and I think it has a lot of things wrong with it. But any of these systems have lots of thing wrong with them. I just think that it is worthwhile exploring the whole question of tradeable emissions. It may not be carbon dioxide is the best issue, it may be that it is sulphurous oxide and nitrous oxide, as has been suggested by some of the Canadian utilities.

It certainly seems to me that it is worthwhile exploring it on a pilot basis, to see what it does in terms of fostering technological change, because that is the major argument for it.

The Joint Chairman: We will now open the debate in order to put questions to each of our three witnesses, Mrs. Arthur, Dr. Bates and Mr. Runnalls.

Mr. Gustafson (Souris—Moose Mountain): My question relates specifically to agriculture. I serve an area in southern Saskatchewan where the drought, whether it is cyclical warming or global warming that has caused the problem, has put us through some very dire times. I was chairman of the task force on drought, and I can assure you that our farmers in that area are wondering exactly what is happening. We had 85 degrees out there last week in southern Saskatchewan.

To get to the numbers, along the border of the U.S., the 49th parallel, is where most of the wheat is grown in Canada. If you go into the statistics you will find that it is not grown in the north. It is grown right in that area within 100 miles of the 49th parallel. We used to say

of the old Assiniboia riding that I served that 40% of all the wheat grown in Canada was grown in that riding. There are questions as to what is happening. I was rather surprised about Dr. Arthur's comments, because they certainly do not indicate what I am hearing at the grass roots.

Another question relating to that is that food is not a priority on the global scale. Wheat is $3 and some cents a bushel. Oil is now $22 a barrel. It was up to $40 in 1972. Wheat was $2 a bushel, and oil was $2 a barrel. I, as a food producer for a lifetime, ask along with my consituents: is food a priority? Are we giving a lot of lip service in terms of the so-called experts on environmental issues, or are we really concerned about the issue in terms of the global picture?

Someone has written a book called *Ending Hunger:* An Idea whose Time has Come. We hear more about hunger today, but there is less priority on food. We have moved to try to pack all of the population of Canada into four cities, and I as a farm boy am wondering is there any future for agriculture. Where are we?

Dr. Arthur: That is a ten-week course. First of all, I think food is a priority, but unfortunately it does not show up through pricing, it shows up through programming. A lot of countries have committed considerable dollars to the food sector, and because of that prices have stayed low. But they have shown a lot of commitment to the agriculture sector through their policies, and I think that will continue.

.1150

As for what is going to happen in southern Saskatchewan, meteorologists in the Prairies tell me that you get these long periods of hot, dry weather every once in a while. The prairie environment is very variable and there is not really such a thing as average weather on the Prairies. You get long, hot, dry cycles and then you get cool, wet ones.

I am not sure that southern Saskatchewan's problem is due to the greenhouse effect. I think most people are telling us we cannot say for maybe another 20 years whether any regional problem is due to this. Some of the models are predicting that southern Saskatchewan will get more moisture under the greenhouse effect, so things could improve. It depends on which model you look at.

Mr. Gustafson: I do not want to isolate it only to southern Saskatchewan, because I have driven the—

Dr. Arthur: But they are the worst off.

Mr. Gustafson: —custom combine belt from Texas, North and South Dakota, Kansas and right through. This happens in the whole area where we produce the grain that the world eats. They used to tell me when I was a boy in school that we fed the world. I know some people challenge it in many ways.

Dr. Arthur: Most of it is desert already and always has been. They have just been irrigating it in the United States.

Mr. Gustafson: Exactly.

Dr. Arthur: Irrigation water is running out with or without the greenhouse effect. This is a policy issue right now.

Mr. Gustafson: This leads to my next question as it relates to environmentalists and experts. I happen to represent the area where the Rafferty–Alameda Dam is on hold. We have a lot of so–called experts from outside, both politically and environmentally, making comments about issues they know nothing about. It really poses a problem. As a representative of the people, I am asked what is going on because those people do not understand the problem.

Dr. Arthur: This is part of the difference between looking at ecological impacts versus economic impacts. People ask why we did not include the ozone hole in our economic impact models. People have tried and can find no economic impact from the ozone hole, but this does not mean there are no impacts. It just means that they are not economic yet or we cannot extrapolate them to economic productivity.

Mr. Gustafson: Without belabouring it, I would only want to make this one point. I think it is very important.

The Joint Chairman: I am sorry, but there are other members who want to ask questions.

Mr. Wilbee: I did not have a question, Mr. Chairman, at this time.

Mr. Halliday (Oxford): Unfortunately, I was unable to be here yesterday, so I appreciate the excellent summary of Mr. Runnalls a few moments ago. It was very well done indeed.

Despite the political popularity right now of this issue of environment, pollution and so on, there appears to be an unwillingness of so many governments at all levels to contribute funds to it. We seem to have a funding problem and it has been touched on very briefly this morning. I am wondering whether our panelists could give us any insight they might have on how this might be approached.

I think most of us understand that if you increase income taxes too high, you have difficulties then with your overall economy. It is the same if you increase corporate taxes too high. We have heard about the excise taxes on coal and carbon fuels already.

Given the fact that over the last four or five decades governments have been most intent upon transfer payments to individuals for individual consumption, pensions, family allowances, health care and so on, has the time come when we have to probably start taking some of that money away? This represents a large percentage of all our government budgets. Has the time come? In some other countries now, in Sweden for example, they are beginning to take moneys away from those payments and putting them into funding efforts, such as environment, that cannot be done by individuals privately but can be done collectively through government funding and only that way really.

Could I have some comments from our panelists on this? We have a former Minister of the Environment here today. What kinds of moneys should the governments be spending now on a yearly basis? What does the infrastructure allow them to spend in terms of the potential for spending money and where will it come from?

.1155

Mr. Runnalls: I do not think there is an absolute answer to the question. On the issue of global warming and atmospheric change, the numbers are very vague. The kinds of numbers one is talking about internationally, which I think Hélène Lajambe mentioned yesterday, are quite large. We are talking about a minimum of probably $20 billion or $30 billion a year. That is what the preliminary numbers seem to be for dealing with carbon dioxide on a major scale.

I mentioned in my summary the critical importance of the ozone discussions. The next round of the ozone discussions will be in June. If we are going to defuse the politics of this, the real north–south split that is building, the easiest one to deal with is chlorofluorocarbons.

We know something about substitutes, and we know something about costs. The Dutch government commissioned McKinsey & Co., the big consulting firm, to do a series of costings to deal with these various problems. They reckoned the total cost of getting the developing countries off chlorofluorocarbons would be something in the order of $150 million to $200 million a year. This is not a lot of money when you consider that the current foreign aid flow is $50 billion a year and that you in fact get a "two–for". You get a reduction of the pressure on the ozone layer itself and also a reduction of CFCs as a greenhouse gas. According to Stephen Schneider, CFCs are also about 20% to 25% of the problem of climate change.

So we have an issue in which we could spend a relatively small amount of money. The $150 million to $200 million a year is world–wide, that is not Canada's share. I suspect Canada's share would probably be $10 million or $15 million. We could also begin to change the political dynamic of what is going on now between the north and the south a little bit and we could make a very major and quite cost–effective impact on both the ozone hole and the whole question of global climate change. So I guess trying to deal with the CFC question is the low end of the spectrum.

Domestic costs in Canada of dealing with CFCs will probably be internalized. In other words, companies will make more expensive refrigerators because the substitute is more expensive and so on. But in terms of moneys paid out of the public purse, if we took a leadership role at the meeting in London in trying to provide financing for alleviating the CFC question, that would be relatively cheap.

When one begins to get into the whole question of carbon dioxide emission controls, the studies I have seen are relatively positive at least up to a point. In other words, it seems to be possible to get quite major reductions in carbon dioxide production without

enormous amounts of public expenditure. It involves energy regulation, appliance efficiency standards and so on.

We could get a certain amount of the way for relatively little cost to the public purse and I suspect enormous benefit in terms of the efficiency of Canadian industry. As Jim MacNeill pointed out yesterday, we are relatively inefficient users of energy. The relatively efficient users of energy are the people who have achieved the most in terms of carbon dioxide reduction. They are our principal competitors, Japan and Germany.

I think we can go a certain degree down the road at either minimal cost to the public purse or even at some advantage. The real work needs to happen now as to where that cut-off point is. In all of these things I suspect it is a bit like pollution control, whereas Mr. Caccia will tell you from his experience as minister that you pay *x* dollars to get 97% of the gunk out of the water, you may then well pay two times *x* to go from 97% to 99% and three times *x* to go from 99% to 99.9%.

I am sure there are similar thresholds in the carbon dioxide removal business and there are lots of things we could do tomorrow about reducing carbon dioxide emissions quite dramatically that would not cost the public purse a lot of money and that would not cost consumers a lot of money. In fact, they might save quite a lot of money.

.1200

The real work we need to do is on establishing where the break is between when these things make economic sense in the current context and when we actually have to begin to change the ground rules to make them make sense in terms of taxes or subsidies or inducements or whatever particular poliy mix you choose to use to persuade people to make that choice. I also agree with Mrs. Catterall that the way to do it is incentives; it is not penalties. We are not going to turn a whole bunch of people into sort of carbon dioxide criminals in this process.

That is not an adequate answer to your question because that leaves aside a whole bunch of other public policy questions about how much money government should spend, doing what for the environment. I would not want to be a politician at the moment trying to make those choices, because what the public wants is a clean environment and there is no sense of the relationship between that and costs, and between those costs and other expenditures of public funds.

We have just done a study of the Great Lakes state of the environment at our institute. One of the most frustrating parts in trying to arrive at any of the public policy recommendations is that there is not any real consensus that we could determine among people who live in the Great Lakes basin about how clean an environment they want, and how much it is they are prepared to pay for it in terms of higher prices, higher taxes, or whatever.

I think that might be the most difficult single issue that you are going to face as political leaders trying to deal with these sorts of problems, reconciling the fact that the public has an enormous amount of enthusiasm for all of these issues.

As Doug Miller pointed out, there is an emormous concern for public health, and this was reinforced by Dr. Bates this morning. When people become concerned in that way they tend to want solutions, and there is then a kind of disappearance of the relative cost of this as opposed to that. I am glad that is your job and not mine.

The Joint Chairman: A person from the public would like to ask a question. Madam.

Ms Jackie Rourke (Reporter, *The Weather Network*): My name is Jackie Rourke and I work at *The Weather Network*. I want to address an issue that was raised yesterday, the confusion among the public. Working in the media, we are trying to sort all this out, just as you are. I would like to hear from the witnesses and from the panelists just whose role is it to clear up some of the confusion. Just this morning Dr. Arthur's speech itself added even more confusion as to whether or not we should even be concerned about climate change and global warming. I think the conclusion from this is that we should be. But whose role is it to explain the causes and effects to the public? Yesterday we heard that 51% have confidence in the science experts, 26% rely on television, only 2% have confidence in politicians. Who do you think should be disseminating the information? Is it in fact important that the public gets a good understanding?

Dr. Arthur: Science is better at creating controversy than solving it. I am not sure it is our place, except maybe in the aggregate bodies to decide where the trend of research is going, and that can put you in a bad place because that is what I tried to do here. In the impacts research the trend is going towards, in climate change not air pollution, benefits to northern latitudes, countries in northern latitudes. I would have been academically dishonest not to present that picture, because I would not be presenting the way that science is moving even though they are individual studies moving in other directions. As these larger scientific bodies develop a sense of where all the research is going, then maybe they can sort it out.

The problem with this issue is we are so early in it that you are getting studies instead of whole scientific consensus.

Ms Rourke: But so often we have heard that we cannot wait the 10 or 20 or 50 years to get that signature that this in fact was caused by global warming. If we cannot wait, is it not important that the public gets educated about it?

Dr. Arthur: I think you are doing a good job. They are getting both sides of the issue. They are confused, like science is confused. I think confusion is the correct stance.

Dr. Bates: I think the answer to your question is on several planes. I would draw your attention to the series *Planet Earth*, produced by the National Academy of Sciences in Washington, for which I do a lot of work. That provides a major source of public education

at depth—not the 30-second slot on *The Journal*, but the depth education on these issues. There is nobody in Canada, other than the media, that has been asked to do that. The Royal Society has not been asked to produce a one-hour videotape on its perception of global climate warming. Without substantial funding, the Royal Society in Canada is quite unable to do that. That is one thing.

.1205

The other thing is at the local level. I spend a lot of my time talking in high schools and writing articles for *The Vancouver Sun*, and in three weeks' time I will take part in a major press conference in Boston on the effect of acid aerosols in the northeast continent. These are efforts to get these perceptions across to the public.

I think the sort of thing David Suzuki does with great success, looking at the wider issues, is another example.

All of these things are very important. I just regret that in Canada, organizations like the Royal Society, which can offer tremendous expertise, have never been able to have an impact similar to the National Academy and its series *Planet Earth*.

Mr. Runnalls: Can I just add to this a sense of proportion. For those in the scientific community, the climate change argument has been around a very long time. For those in the public policy community and in the press and the public at large, I suspect the first time anyone had any sense of it was at the changing atmosphere conference in Toronto. The main reason why that happened was that it just happened to be a very dry summer and very hot and the Governor of Illinois decided he wanted to divert the Great Lakes down the Mississippi River. That got on the front pages of the papers.

The fact is this is an issue that has been around in public policy for barely two years. As you can hear from the discussions here, it is an immensely complicated issue that goes right to the root of the way in which both economic systems and energy systems function, and I do not find it at all surprising that everybody is at a very early stage of understanding it. I do not think that is an excuse for inaction, but I do not think we should throw our hands up in despair and say, the Canadian public does not understand this; somebody better inform them.

I think this is one of a whole series of similar fora that are going on around the world and around Canada that will give the media a chance to expand its coverage of these issues. I am sure you have to fight with your editor for space, the way everyone else does. But I hope it will begin to force more members of the Canadian scientific community to come out of the closet and speak on public issues, because in my experience the Canadian scientific community, with the notable exception of people like Professor Bates, are much less willing to engage in the kind of public debate that the scientific community in Britain and the United States is, and they are a critical ingredient in the formation of public attitudes on this issue.

The Joint Chairman: I believe the founder of Earth Day in Canada would like to say a few words.

Mr. John McConnell (Founder of Earth Day): Thank you. By the way, when we are talking about climate change, I noticed in today's *Ottawa Citizen* that the mastodon was not eliminated by a larger animal but by changes in climate. I guess what we need all over the world is a change of climate in our thinking.

I wanted to address a couple of things and ask a couple of questions. There are so many solutions to energy: for instance, nitanol—there has been a great deal of work done on this; it is a most efficient and clean energy and could change the world. I see so little reference to these solutions.

Another thing I want to mention is there is no mention, for example, of Alden Bryant, a leading scientist in California, who testified at the United Nations that our danger is not global warming but global cooling, that we are on the verge of the ice age. I just wonder if the thinking on that stand in regard to the future could be addressed. Certainly one thing that is certain is no longer is nature deciding the future. Now nature is dead and man is deciding the future. But we had better learn some of nature's secrets before we proceed. Again, I would like an answer to the global cooling. Thank you.

.1210

Mr. Runnalls: I am sorry, Mr. McConnell, I did not hear the entire question. I was busy, as you can see, positioning myself over there so the television cameras would point at me rather than the minister.

My impression is that the warming or cooling debate has been resolved. There are very few, if any, remaining exponents of the new ice age theory.

Mr. McConnell: Well, Alden Bryant testified recently at the United States—

Mr. Runnalls: I am aware of that. I think one of the things one has to remember is what Steve Schneider said yesterday, that there is a very real danger in paying attention to either the last piece of testimony or the last study done on this issue.

I think one of the great services the National Academy of Sciences has done in the United States is to put these sorts of things through the appropriate peer review process, so that when a study actually comes out that is comprehensive, it is one that has allowed for a wide range of comment on the part of the scientific community.

I am not saying this gentleman is necessarily wrong. He is certainly well off the beaten track in the consensus these days. My guess is that if he has followers of his particular approach, it will come out in the normal scientific peer review process.

I take Stephen's point very much that the scientific review process is an important part of the scientific method. By springing various studies on the press and on the public, one after the other, studies that are not peer–reviewed, one contributes to the air of confusion.

So I suspect that if his point is germane, there will be other people in the scientific community who still subscribe to it. I suspect it will go through the normal peer review process. I would hate to comment any more than that at this stage. I will now get out of the way for the minister.

The Joint Chairman: I would like to thank the members of the Standing Committee on Employment and Immigration, the Standing Committee on Health and Welfare, Social Affairs, Seniors and the Status of Women and the Standing Committee on the Environment for their contribution to this morning's debate. I would like to thank as well our three witnesses, Dr. Arthur, Dr. Bates and Dr. Runnalls, for their contribution. We have had a very interesting debate.

The time has come for me to give the floor to the chairman of the parliamentary forum, Mr. Brightwell.

CLOSING PLENARY SESSION

Agriculture

Energy, Mines and Resources

Environment

Forestry and Fisheries

Health and Welfare, Social Affairs,
Seniors and the Status of Women

Industry, Science and Technology,
Regional and Northern Development

Labour, Employment and Immigration

Transport

The Chairman: Thank you, Mr. Blackburn, for chairing an excellent session this morning.

Mr. Bouchard, colleagues, ladies and gentlemen, I want to make just a very few remarks before I have the minister take the floor. I know he has a limited amount of time. The proceedings hereafter will only take a few minutes.

You will know that I am not David MacDonald, who is on the agenda. Unfortunately, David is tied up in the constitutional committee out west. He sends his apologies.

I want to tell you that David was very instrumental in getting this event off the ground. Without his initial support there is no way our committee, working through the agricultural committee, could have staged an environmental forum. He took the position that it was a good idea, that in fact the environmental issue covered all aspects of life in Canada, and that indeed it was not unusual that the environmental committee would lead.

We also of course received great support both from the Speaker of the House and from the leaders of the House. They had to make the special orders to allow this to happen.

Before I go on, I want to thank the staff in my own office, my committee staff, the researchers, the clerks, the whole House staff, who have all worked so well to make this happen. Many new things have occurred. In fact, maybe many of the advantages of what has happened will be in the precedents that were set here today in the new committee structure.

.1215

I want to thank the colleagues who sat around the table, so many of you in and out as we do our other duties, for keeping the meetings on a non-partisan basis. Even some of the partisan things were said on a non-partisan basis. I think that is fair to say this morning.

We have achieved our immediate purpose. Mine, by the way, was simply to have efficiency in committee structure, that we would not be bringing a group of witnesses here to speak to a group of committees separately but we would get together and have one platform where we could set a base. As the idea grew, we knew that we could increase the awareness of Members of Parliament, we could share information across committee structures, and we could demonstrate our concern to the people of Canada through this effort.

Through our joint proceedings and through video recordings, we will have a textbook, shall I say, of global climate change for the moment. Undoubtedly that textbook will get outdated very quickly.

The benefits in the long term of this procedure will be seen through committee work, because it is just a part of what the regular committees do every day in their study of their particular issue in the environmental field. As I said before, maybe other long-term benefits will come about through committee co-operation.

Before I turn the floor over to the minister, I want to say that an environmental fair is going on, a very informative affair, in Room 200 in the West Block. It will continue until 6

p.m. today, and I urge you to go over yourselves. I have been too busy to do more than say hello to them, but go over and talk to the people there—non-government agencies, a lot of them, particularly two student groups. So I urge you to support the environmental fair.

I am pleased that the Minister of the Environment, the Hon. Lucien Bouchard, could find time in a very busy schedule to come and speak to us today very briefly and to wind up the program for the environmental forum. Mr. Bouchard, I give you the floor.

Hon. Lucien Bouchard (Minister of the Environment): Ladies and gentlemen, dear friends, nothing is more true than what Mr. Brightwell has just said about the fact that environment is a non-partisan issue. But at the same time I could not help seeing a paradox in the fact that this great non-partisan meeting was being held in the room where the national Tory caucus is meeting each week.

I think this meeting is very helpful, and I also think that it helps us to realize that global climate change is a complex issue requiring concerted action by all sectors of society. In particular, energy policies, agricultural and forestry practices, and land use options will have a significant impact on climate change.

This parliamentary forum has been a unique event which recognizes the need for consideration of the issue by all sectors of society. New approaches and new kinds of co-operation are required to respond to the threat of global climate change.

Last week in Washington, policy makers from 17 countries convened to discuss the issue of global warming and, more generally, global environmental change. Importantly, nations agreed on the necessity for action in the face of uncertainty. As President Bush said in his closing remarks, research is no substitute for action. And action is the key word. We must act now.

Canada is a full participant in international fora dealing with the climate change issue. The White House conference was one in a continuum of such meetings, each of which takes us a step closer to the signing of a convention for the protection of the atmosphere and significant protocols under that convention.

Just a word about the Washington White House conference last week. This conference was very interesting. I know that there have been reports on the differences of views between mainly the European and American delegations. It is true that during the first day the impressions and the perceptions from the people coming from Europe were rather negative. They thought that the Americans, in trying to promote research, economic assessments, were trying to dilute the issue and to pre-empt the conference that will be held in Geneva next November just after the tabling of the very important report of the IPCC on what countries should and can do in terms of targets and schedules.

.1220

But during those first days it was obvious that there is a dimension very important in environment: it is the political aspect, the political pressure. We all generally in Canada and

within our government think of political pressure exerted upon governments in terms of domestic pressure, but in Washington it was obvious that the domestic pressure is also translated into a very strong, intense, and I would say irresistible international political tension. The Americans could see that, and there was some kind of an evolution during the discussions over two days, and at the end of the second day the President came back with the second speech; and contrary to what he did during the first speech, where he stressed—and I would say it is legitimate, because we need more science and more research—mainly the economic and scientific aspect of it, during the second speech he stressed the action issue and he said what I just quoted in French, that research cannot be a substitute for action as far as global changes are concerned.

So there is quite a collective international education going on in the approach that the governments must have towards environment and those global issues.

Effective international action must go hand in hand with the development of a clear domestic strategy. Over the next few months we will be sitting down with Canadians from all walks of life—industry, non-governmental organizations, government, etc.—to develop for the fall a national plan, a plan to set the course for dealing with global climate change.

We will commit ourselves to a plan of action that will contain targets and schedules. I think our country is at the core of something very important for its own international reputation. We are perceived.... I know that our friends from the other side of the House do not agree with that, but it is true, if you go to different international conventions and conferences.... I do not know what, for example, our honourable colleague Mr. MacLaren would say. He was in Washington on Sunday at the Trilateral Commission when I addressed the commission, and he must be a witness too of the fact that the general perception of Canada in environment is that we are leaders and there is a very high expectation from us.

Why? Because we have done a lot on this. We know maybe more than many countries about the way to mesh the economic and environmental considerations in the decision-making. We have been very successful in the acid rain reduction program. We have convinced the Americans to table the bill that is under study in the Congress, and we were instrumental in the Montreal Protocol in Montreal two years ago. Do not forget that it was the first international convention of this kind in environment. Never before in history had such a convention been agreed by the world. It was done in Montreal, and the fact that it was in Montreal was not a coincidence. When a convention like this is held in a city in a country, it is because this country is perceived as being a leader and has pushed and is deserving to host the conference.

We have this reputation that is nice, but at the same time I personally believe that the time is coming, and time is short, when people will ask us to translate this reputation into action, and no international action will be credible if it is not founded on a very strong and serious and significant domestic program.

That is why the exercise that is going on, this consultation process that will be launched in a few days, is of profound importance for Canada. People are very interested by the fact that we have decided to set up a consultation process before. It is not the way it is done in other countries, but this is also our reputation—to consult people in informal ways, not only through institutions, not only through parliamentary commissions or committees, but ministers and politicians going to see the people and hearing what they have to say, testing their reaction to statements and questions to determine the extent to which we will be able to get political support for tough measures. Do not forget that this will be quite a test for Canada. All of us are reading polls that say Canadians would be ready to do a lot for the environment: lose jobs, pay more taxes, accept radical personal changes.

.1225

This fall Canadians will be asked to live up to what they say. They will have to translate their concerns into concrete commitments. It will be a tough thing for the government. We know a bit about that because we are in the process of enacting tough regulations for the pulp and paper industry and the auto industry. We know their reaction. We need the people. We have to convince the people and we have to push them. In the end the government and Parliament will have enact the proper regulations and legislation.

We are also in the process, in different committees, of drafting the new legislation on the environmental assessment of government projects. We have to have mechanisms for all those questions. I can see that government is also a body. Government machinery is something that exists, something real. It has a culture, with traditional and quite normal resistance to change. It is not only a question of party. Parties are out there promising very nice things. But a government also has tradition. Bureaucracy has tradition. And when it comes to a new law in which the decision-making power would be limited, do not forget that you have to convince a lot of people. We are doing this now.

I think that the next month will be crucial for the environment issue in Canada. It will also be critical for maintaining Canada's reputation in the world as an environmental leader. The joint committee hearings of the last two days have been important—not only in increasing the understanding of global change, but also in building consensus on appropriate policy measures.

I would like to thank all those who have taken part in the parliamentary forum on global climate change, and above all—giving credit where credit is due—I would like to thank the Speaker of the House, Mr. John Fraser. Mr. Fraser is a well-known friend of the environment and we all stand to benefit from his firm commitment to this cause. We should also thank Mr. Brightwell, who first thought of holding this forum, for having set an example of the kind of innovative approach climate change requires.

I would also like to thank very much the distinguished speakers who have come here from the United States and from all over the world. Their contributions will help to enrich our future discussions. They have both informed us and increased our interest in the issue.

The interest shown by members of Parliament, moreover, is most encouraging. The discussions they have had at committee hearings over the past two days show that they want very much to help in finding solutions to the problem of climate change.

Further, members of the general public who have taken the trouble to come here to learn more about this issue should know that their concern and involvement has not gone unnoticed.

I would like to thank you all and wish you good luck and a good trip back to your countries.

The Chairman: Mr. Minister, thank you so much for your very kind words.

Mr. Caccia: Would the minister accept some questions? We are only asking for one round of questions per party.

The Chairman: I did not make any arrangments for questions.

Mr. Caccia: The minister is strong enough to accept one round of questions, Mr. Chairman.

The Chairman: I do not feel this is in order, Mr. Caccia, and I want to proceed with the remainder of what I have, which is very limited.

Mr. Minister, we thank you for taking the time to come here this morning. We all know a little bit more about your problem and the difficulties you will have in solving them. We wish you godspeed in your work in the environment.

Mr. Bouchard: Mr. Chairman, if you agree, I would not be opposed to receiving one question per party. How many parties have we?

.1230

The Chairman: When my minister speaks, I will obviously listen. I will not take the floor again, other than to adjourn it, but I want to do two things. I want to thank the committees who helped me organize, and the chairpeople, many of whom sat here this morning. I failed to do that before.

Secondly, I want to announce very clearly that there is a joint proceeding, which is a very unusual circumstance for anything in this House. They will be available afterward to a limited number. They are quite expensive to produce, and we will have some 4,000, I think, but that may not be too many. I am prepared to let this go on. I will put this in your hands, Mr. Blackburn.

The Joint Chairman: Fine. We will now allow some questions. Mr. Caccia.

Mr. Caccia: In his speech this morning, the Minister of the Environment emphasized the considerable impact of energy policies on our ability to solve the problems of global climate change. What kind of changes in Canada's energy policy would the Minister like to see?

Mr. Bouchard: Well, I see there being two types of changes required. The first, which are the least difficult to effect, because none of this will be easy, and which seem the most logical, would be strict energy conservation measures. This is something we must tackle head–on.

The second type would be even more radical measures under substantial new energy programs. You are absolutely right: the energy sector is certainly one of the areas where we will have to work with tremendous vigour. We are all aware of the political problems that this is likely to cause for Canada as a whole. We are also all aware that we will have to be fair in the process. Certain regions of the country are linked with specific forms of energy, as we all know. There are also local economies that might be directly affected by ill–considered action on our part. So, in the second stage of our two–pronged attack, when it comes time to take steps that involve the substance of our energy policies, we will have to be both fair and innovative. I see such initiatives also having a tax component.

Mr. Fulton: I think a lot of Canadians were alarmed in the last few days to hear the Minister of Energy suggesting that to realistically meet new air pollution target standards we would have to stop using motor vehicles in the major cities in Canada. We heard from expert witnesses today and yesterday, for example, that Great Britain could save 140 million pounds, about a quarter of a billion dollars Canadian, going to energy efficiency and conservation. Germany is going to reduce greenhouse emissions by 25% and make money doing it. Sweden is going to do the same thing.

Why is it that neither your ministry nor the Minister of Energy, Mines and Resources have taken the time to evaluate the DPA study, which is the Canadian contemporary of the British study, the Swedish study and many other studies that have been done, which indicate, through energy efficiency and conservation for Canada, we can reduce the amount of carbon dioxide released by two–thirds and at the same time save every man, woman, and child in Canada $5,000? As I said earlier today, it seems to me that nothing could be more popular for a government than saying they are going to save us each $5,000 and reduce greenhouse gas emissions, at least of carbon dioxide, by two–thirds.

Why is it that neither Environment Canada nor Energy, Mines and Resources have ever done an evaluation or ever publically stated why this report was rejected, when it seems to be the route that most other countries in the world are going who are taking global warming seriously? If you can reduce greenhouse gas and save money for the consumer, is that not really what we should be talking about, instead of making statements? Frankly, Minister, I know you personally well enough to know that you know that the statement that we would have to stop using cars in all of Canada's major cities is false. It is an unfortunate kind of approach for any minister of the Crown to take to an issue that is so serious.

Mr. Bouchard: There are many questions in this. My honourable colleague has a way of meshing all kinds of questions into the same question. It is as if the NDP has a ratio of three questions against one for the other parties.

One thing about my colleague's statement.... I want to be fair to him. I spent part of the week with him in Washington at this White House conference. The night before the second day of the conference we had a large meeting of the Canadian delegation, and I was supposed to, and in fact I did, chair one of the working sessions of the second day, which was very important for us. I drafted a speech. Then during our meeting I had a lengthy discussion and consultation with Jake Epp, my fellow Minister of Energy in this Cabinet. We agreed we must put in this speech a commitment to include in the "Green Plan" of the fall the commitment that there would be targets and schedules in it.

So there is no difference of view, there are no bones of contention between Jake Epp and me. I would like to clear up the record by saying that one of the most supportive ministers in the Cabinet environment committee is Jake Epp. We work very closely together. I have no problem with Jake Epp at all. Sometimes it is difficult to reconcile the different reports coming from the different parts of the country on what we say, because we are doing a lot of scrums. But the bottom line is that we have a joint commitment to have targets and schedules.

What will the levels be? Well, of course we are still working on it. For example, you referred to the German commitment, which will come, we understand, maybe in Bergen or in Geneva, to a reduction of 25%. Well, we have worked with the Germans. My deputy has sat down with the German deputy and we have a fair knowledge of the kinds of measures they will use to reach 25%. The list of the energy conservation measures they have in mind, for example, and which in their appreciation would result in a 25% reduction, when applied to Canada would give a figure of about 10% or 12%.

So we have a problem to reconcile those data, because the data are not uniform. We still have to know more—and we are working very actively on this—in in terms of a grill to assess the different data from the different parts of the world. But the kind of things you could do in Canada would end up in a 10% reduction.

We would like to do better. We do not know if we can. But we have to be responsible. We are the kind of country...I do not want to say anything negative about the other countries, but our culture in North America, and mainly in Canada, is that if we make a commitment, if we say in the year 2005 we will have achieved a 20% reduction—suppose we say that—at the same time we will have to say what measures will be implemented to achieve this. We have to establish the cost. We have to know exactly what the down-side would be to the economy, what kind of compensation we will have to establish. People will not believe us if we do it otherwise.

So the day we make a commitment we will fulfil it. We will say how it will be achieved, and it will be serious.

Mr. Charles A. Langlois (Manicouagan): Over the past day and a half, we have heard many comments about the impact of deforestation, clear-cutting, what is taking place in the tropical jungle and other practices on global warming.

I would like to hear your comments on how Canada perceives that problem. What does the government intend to do in order to minimize our contribution to the problems caused by the destruction of the forests?

Mr. Bouchard: One of the things that surprised me when I began attending international conferences on the environment was that Canada does not have all that good a reputation with respect to the way it manages its own forest.

For example, I appeared as a witness before a parliamentary commission of inquiry established by the Bundestag, in Bonn. I was a witness at a three-hour session where we discussed Canada's difficulties and what we intend to do about them. They, too, are in the process of preparing a plan. In the course of our discussion, I realized that they had a rather negative perception of Canadian harvesting practices.

So, our fine words about how we must protect our own natural resources, which are like a sacred trust held by Canadians for the rest of the planet, have finally been thrown back at us. And they are being thrown back at us more and more at these international conferences.

Last week in Washington, I included in my commitment the undertaking to review our forestry policy and implement new ones in Canada. Although I am certainly not trying to pass the buck, we all know full well that under the Constitution, the provinces have primary jurisdiction over forestry matters, and that it is very difficult for the federal government to interfere in provincial affairs. It is the same old co-existence problem.

On forestry, environment and energy federal-provincial committees, however, we are increasingly establishing national standards. How can we do this? Well, when the federal government commits considerable sums of money to the implementation of forestry policy, it can impose certain conditions and force the provinces to meet standards that we will jointly define.

The Joint Chairman: Dear colleague, I would like to thank you all for your participation and for your questions and comments. Mr. Chairman, my congratulations to you on an excellent parliamentary forum.

The meeting is adjourned.

MINUTES OF PROCEEDINGS

MONDAY, APRIL 23, 1990

[*Text*]

The Standing Committees on Agriculture, Energy, Mines and Resources; Environment; Forestry and Fisheries; Health and Welfare, Social Affairs, Seniors and the Status of Women; Industry, Science and Technology, Regional and Northern Development; Labour, Employment and Immigration; and Transport, met jointly at 10:34 o'clock a.m., this day, in Room 253–D, Centre Block, the Chairmen, Harry Brightwell, presiding.

Members of the Committees present: *From the Standing Committee on Agriculture:* Harry Brightwell, Ralph Ferguson, Maurice Foster, Rod Laporte, Gabriel Larrivée, Joe McGuire, Ken Monteith, Ross Stevenson, Lyle Vanclief. *From the Standing Committee on Energy, Mines and Resources:* Yvon Côté, Al Johnson, Charles Langlois, René Soetens, Scott Thorkelson. *From the Standing Committee on Environment:* Charles Caccia, Marlene Catterall, Rex Crawford, Stan Darling, Jim Fulton. *From the Standing Committee on Forestry and Fisheries:* Brian Gardiner, Charles Langlois, Charles–Eugène Marin, Peter McCreath, Ken Monteith, Fernand Robichaud, Dave Worthy. *From the Standing Committee on Health and Welfare, Social Affairs, Seniors and the Status of Women:* John Cole, Robert Porter. *From the Standing Committee on Industry, Science and Technology, Regional and Northern Development:* Bill Casey, Steven Langdon, Howard McCurdy, Brian O'Kurley, Barbara Sparrow. *From the Standing Committee on Labour, Employment and Immigration:* Jean–Pierre Blackburn, Al Johnson, Allan Koury, Dave Worthy. *From the Standing Committee on Transport*: Iain Angus, Les Benjamin.

Appearing: The Honourable John Fraser, P.C., M.P., Speaker of the House.

Witnesses: From CROP Inc.: Alain Giguère, President. *From Synergistics Consulting Ltd.:* Doug Miller, President. *From the National Center for Atmospheric Research:* Dr. Stephen Schneider. *From the Institute for Research on Public Policy:* Dr. Jim MacNeill, Director of the Environment and Sustainable Development Program.

Pursuant to the Special Orders dated March 28 and 30, 1990, the Committees met jointly to hold a Parliamentary Forum on Global Climate Change.

The Speaker of the House opened the Forum.

The witnesses made statements and answered questions.

At 1:00 o'clock p.m., the Committees adjourned.

MONDAY, APRIL 23, 1990

The Standing Committees on Industry, Science and Technology, Regional and Northern Development; Transport; and Energy, Mines and Resources met jointly at 3:36 o'clock p.m., this day, in Room 253–D, Centre Block, the Co–Chairmen, Barbara Sparrow and Charles Langlois, presiding.

Members of the Committees present: *From the Standing Committee on Industry, Science and Technology, Regional and Northern Development*: Jack Anawak, Bill Casey, Howard McCurdy, John Manley, Barbara Sparrow. *From the Standing Committee on Transport*: Iain Angus, Denis Pronovost, Larry Schneider. *From the Standing Committee on Energy, Mines and Resources:* Ross Harvey, Al Johnson, Charles Langlois, René Soetens.

Other Members present: Harry Brightwell, Charles Caccia, Marlene Catterall, Stan Darling, Ralph Ferguson, Maurice Foster, Jim Fulton, Stan Hovdebo, Gabriel Larrivée, Bob Porter, Roger Simmons, Ross Stevenson, Dave Worthy.

Witnesses: From the Royal Society of Canada: Dr. Digby McLaren, President. *From the Canadian Automobile Association:* Michael McNeil, President. *From the Centre for Energy Policy Analysis:* Dr. Hélène Connor–Lajambe, President and Managing Director.

Pursuant to the Special Orders dated March 28 and 30, 1990, the Committees met jointly to hold a Parliamentary Forum on Global Climate Change.

The witnesses made statements and answered questions.

At 6:04 o'clock p.m., the Committees adjourned.

MONDAY, APRIL 23, 1990

The Standing Committees on Forestry and Fisheries; and Agriculture, met jointly at 7:31 o'clock p.m., this day, in Room 253–D, Centre Block, the Chairman, Charles–Eugène Marin, presiding.

Members of the Committees present: *From the Standing Committee on Forestry and Fisheries*: Charles Langlois, Charles–Eugène Marin, Peter McCreath, Ken Monteith, Fernand Robichaud, Dave Worthy. *From the Standing Committee on Agriculture*: Harry Brightwell, Maurice Foster, Ken Hughes, Ken Monteith, Rod Laporte, Ross Stevenson, Lyle Vanclief.

Other Members present: Charles Caccia, Stan Darling, Jim Fulton, Francis LeBlanc, Robert Porter, Walter Van De Walle.

Witnesses: *From the Maurice Lamontagne Institute*: Jean Boulva, Regional Director, Science. *From Forestry Canada:* Jag Maini, Assistant Deputy Minister for Policy. *From the Saskatchewan Research Council*: Dr. Elaine E. Wheaton, Lead Scientist, Climatology Section.

Pursuant to the Special Orders dated March 28 and 30, 1990, the Committees met jointly to hold a Parliamentary Forum on Global Climate Change.

The witnesses made statements and answered questions.

At 9:52 o'clock p.m., the Committees adjourned.

TUESDAY, APRIL 24, 1990

The Standing Committees on Labour, Employment and Immigration; Health and Welfare, Seniors and the Status of Women; and Environment, met jointly at 9:53 o'clock a.m., this day, in Room 253–D, Centre Block, the Chairman, Jean–Pierre Blackburn, presiding.

Members of the Committees present: From the Standing Committee on Labour, Employment and Immigration: Jean-Pierre Blackburn, Al Johnson, Allan Koury, George Proud, Dave Worthy. *From the Standing Committee on Health and Welfare, Seniors and the Status of Women:* Chris Axworthy, John Cole, Mary Clancy, Barbara Greene, Bruce Halliday, Robert Porter, Stanley Wilbee. *From the Standing Committee on Environment:* Charles Caccia, Marlene Catterall, Stan Darling, Jim Fulton, Lynn Hunter, Brian O'Kurley, Robert Wenman.

Other Members present: Harry Brightwell, Maurice Foster, Leonard Gustafson, Ken James, Stan Keyes, Charles Langlois, Gabriel Larrivée, Nic Leblanc, Charles-Eugène Marin, Howard McCurdy, Joe McGuire, Ken Monteith, Fernand Robichaud, Barbara Sparrow, Scott Thorkelson, Robert Wenman.

Witnesses: From the University of Manitoba: Dr. Louise Arthur, Professor, Department of Agricultural Economics and Farm Management. *From the University of British Columbia:* Dr. David Bates. *From the Institute for Research on Public Policy:* Dr. David Runnalls, Associate Director, Environment and Sustainable Development Program.

Pursuant to the Special Orders dated March 28 and 30, 1990, the Committees met jointly to hold a Parliamentary Forum on Global Climate Change.

The witnesses made statements and answered questions.

At 12:13 o'clock p.m., the Committees adjourned.

TUESDAY, APRIL 24, 1990

The Standing Committees on Agriculture; Energy, Mines and Resources; Environment; Forestry and Fisheries; Health and Welfare, Social Affairs, Seniors and the Status of Women; Industry, Science and Technology, Regional and Northern Development; Labour, Employment and Immigration; and Transport, met jointly at 12:14 o'clock p.m., this day, in Room 253-D, Centre Block, the Co-Chairmen, Harry Brightwell and Jean-Pierre Blackburn, presiding.

Members of the Committees present: *From the Standing Committee on Agriculture*: Harry Brightwell, Maurice Foster, Gabriel Larrivée, Joe McGuire, Ken Monteith. *From the Standing Committee on Energy, Mines and Resources*: Al Johnson, Charles Langlois, Scott Thorkelson. *From the Standing Committee on Environment*: Charles Caccia, Marlene Catterall, Stan Darling, Jim Fulton, Lynn Hunter, Brian O'Kurley, Robert Wenman. *From the Standing Committee on Forestry and Fisheries*: Charles Langlois, Charles-Eugène Marin, Ken Monteith, Fernand Robichaud, Dave Worthy. *From the Standing Committee on Health and Welfare, Social Affairs, Seniors and the Status of Women*: Chris Axworthy, Mary Clancy, John Cole, Barbara Greene, Bruce Halliday, Robert Porter, Stanley Wilbee. *From the Standing Committee on Industry, Science and Technology, Regional and Northern Development*: Nic Leblanc, Howard McCurdy, Brian O'Kurley, Barbara Sparrow. *From the Standing Committee on Labour, Employment and Immigration*: Jean-Pierre Blackburn, Al Johnson, Allan Koury, George Proud, Dave Worthy. *From the Standing Committee on Transport*: Stan Keyes.

Other Members present: Ken James, Leonard Gustafson.

Appearing: The Honourable Lucien Bouchard, Minister of the Environment.

Pursuant to the Special Orders dated March 28 and 30, 1990, the Committees met jointly to hold a Parliamentary Forum on Global Climate Change.

The Minister made a statement and answered questions.

At 12:41 o'clock p.m., the Committees concluded their proceedings.

Carmen DePape
Committee Clerk