The Future of Our Mountains

Climate Change Impacts On The Canadian Alpine

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It is my pleasure to summarize the directions of the last two days of this workshop and to point to policy options open to the Alpine Club of Canada and its membership as we come to terms with growing climate-related concerns.

It is important to point out that the idea for this climate workshop was inspired by a conversation with Dr. Carl Hannigan at the commemoration of the new Fay Hut. The kinds of energy efficiency Dr. Hannigan and his Facilities colleagues are utilizing are examples of best practices that are also excellent adaptations to climate impacts. From this we are introduced to the first important lesson of this workshop namely that it is important to concentrate on what we know instead of what we don't know.

Though most people think that climate change issues emerged out of a suddenly enemy sky in the last decade, we have actually known about the threat increased carbon dioxide in the atmosphere will bring for a very long time. Remarkably, there is a strong historic link between mountaineering and the origins of climate science. The renowned Irish physicist John Tyndall was one of the most famous mountaineers of the 19th century. In 1858, Tyndall made the first solo ascent of Monte Rosa. Three years later he made the first ascent of the Weisshorn and later made the second ascent and the first traverse of the Matterhorn. His highly celebrated book, *Hours of Exercise in the Alps*, remains a classic today.

Tyndall's mountaineering interests extended to his scientific work when he began to focus on the "wondrous factory" that is the atmosphere. Through careful examination of the composition of the Earth's atmosphere, Tyndall was the first to discover the heat absorbing qualities of both carbon dioxide and water vapour.

In 1859, Tyndall also predicted that a water vapour feedback mechanism initiated by carbon dioxide could dramatically increase the mean temperature of the Earth's atmosphere. The carbon dioxide concentration in the Earth's atmosphere during Tyndall's time was only about 290 parts per million.

The scientific community didn't pay much attention. They weren't interested in climate. They were interested in ice ages. Ice was all the rage in the late 19th century. In fashionable salons all over Europe, educated people were speculating on the origins glaciers and the mechanics of their advance and retreat.

In the 1870s a British geologist named James Croll noted that when snow and ice covered a region it would reflect most of the sunlight back into space. Bare, dark soil and forests would be warmed by the sun, by a snow-covered region invariably remained coo. If India managed somehow to be covered with ice, he surmised, its climate would be colder than England's.

But then in 1896, the famous Swedish physicist Svante Arrhenius speculated that ice ages came and went in some sort of dance with the amount of carbon dioxide in the atmosphere.

Following on the heels of John Tyndall, Arrhenius put forward that crucial changes took place in the amount of water vapour in the atmosphere as temperatures rose and fell. He was also among the first to describe what would later be called the Earth's atmospheric "greenhouse" effect.

Even as a mere theory, there was a good deal of reason to dismiss Arrhenius's ideas. Laboratory experiments suggested that there was no foundation for the notion of a "greenhouse" effect in the Earth's atmosphere. Most scientists believed that Arrhenius has missed the boat.

In the 1920s, a geochemist named Vladimir Vernadsky translated what he learned while mobilizing Russia's industrial production for World War I into new perspectives about the potential of life forces to shape global climate.

Many decades ahead of his time, Vernadsky recognized that the volume of materials produced each year by human industry was beginning to assume geological proportions. Analyzing biochemical processes, Vernadsky concluded that most of the oxygen, nitrogen and carbon dioxide that made up the Earth's atmosphere were put there by living organisms.

Vernadsky then argued that living processes shaped the nature and character of the planet in every bit as significant a way as natural physical forces.

Vernadsky's visionary proclamation that humans were, in fact, a geological force in their own right was not widely accepted. Most of the scientists of his day thought him a romantic nut-bar.

At the same time, another Russian, Milutin Milankovitch, proposed that variations in the orbital pattern of the Earth were the likely cause of ice ages. The influence of such slight changes, however, didn't jive with the then established notion of four major historic glacial periods.

It wasn't until the big droughts of the 1930s that anyone began looking seriously again at how climate change could ultimately affect the course of empire and the future of civilization. The Dust Bowl catastrophe that wiped out 250,000 farm families on the Great Plains got everyone's attention - but only briefly.

While some scientists wondered if the diminishment of rainfall over centuries might not have spelt the end of a number of ancient Near Eastern civilizations, the general sense was that if changes in climate really did affect human survival, they were the result of localized impacts that struck one or another region. Such disruptions of what most scientists thought a relatively stable planetary climate could never occur on a global scale.

But suddenly people began to see anomalies in the climate record.In 1938, an amateur climatologist named Guy Stewart Callendar stood before an astounded Royal Meteorological Society in London, England and explained that his hobby was putting together weather statistics and that his numbers indicated – more thoroughly than anyone else – that the atmospheric temperature of the Earth was rising.

Callendar also claimed to know the cause. He argued before this august body that the burning of millions of tons of fossil fuels was warming the planet. Most of the members of the Royal Society thought he was nuts. But not all of them.

In 1947, with World War II over, scientists created the foundation for international sharing of data and analysis in all fields. Much of the data that has been shared since relates to climate.

In 1956, Norman Phillips devised a computer program that allowed him and other scientists to model the movement of the upper atmospheric jet-stream and the evolution of realistic-looking weather disturbances over a period of weeks.

For the first time scientists could imagine how giant eddies spinning through the atmosphere could transfer energy around the globe. This computerization breakthrough became the foundation for later general atmospheric circulation models.

That same year, Gilbert Plass, a weapons research scientist at Lockheed in California discovered that increased carbon dioxide concentrations in the atmosphere would impact the amount of radiation that escaped from the Earth's surface into space. Plass announced that his calculations indicated that human activity would raise the average global temperature "at the rate of 1.1°C per century."

In 1957, Roger Revelle at the Scripps Institute of Oceanography in California discovered that carbon dioxide generated by human activity is not readily absorbed by the world's oceans. Revelle concluded that the amount of carbon dioxide in the Earth's atmosphere would gradually rise over the next few centuries and then level off with a total increase of about 40% over 1957 levels. He didn't worry, however. He thought the 21st century was a long way off.

In 1958, a University of Wisconsin meteorologist named Reid Bryson observed there was no longer a distinction between polluted and unpolluted atmosphere on Earth. A global haze was beginning to form. Moreover, what we put up in the air went everywhere. The notion of "smog" was born.

In that same year, astronomical studies of Venus give clear evidence that a greenhouse effect has raised the planet's surface far above the boiling point of water.

In 1960, an American named Charles Keeling initiated the longest running carbon dioxide concentration baseline on the planet at an observatory on Mona Loa in Hawaii. When Keeling began collecting his data, the atmosphere concentration of carbon dioxide is 315 parts per million.

Keeling's data gradually accumulates to become what is now famously known as "The Keeling Curve". This curve demonstrates a long-term rise in atmospheric carbon dioxide concentrations on a global basis. The annual fluctuations in the curve illustrate how Northern Hemisphere plants take up carbon dioxide during summer growth and release it during winter decay.

In 1963, an American astrophysicist named Walter Roberts demonstrated that aircraft were beginning to affect climate on heavily travelled flight paths by introducing large

volumes of water vapour and aerosols at high altitudes which induced cloud formation. Roberts dissuaded the American government from investing in super-sonic passenger and transport planes for fear that they would introduce water vapour and others exhausts into the high, thin stratosphere, where natural aerosols were rare and where any new chemical would linger for years.

In 1968, Reid Bryson's team made another discovery. By examining radiocarbon dates from pollen, they discovered that substantial climate changes could occur, not within thousands of years as everyone had anticipated, but within as little as a century.

In 1969, while the first humans walked on the moon, the Nimbus III satellite begins to broadcast to Earth the first comprehensive global atmospheric data.

In 1975, concerns about the upper atmospheric effects of jet aircraft led to research into the concentrations of trace gases in the stratosphere.

This research led to the frightening discovery that the Earth's ozone layer was threatened by Chloro-flourocarbons or CFCs.

In 1977, a World Climate Conference was held in Geneva at which 300 experts from over 50 countries concluded that an increase in carbon dioxide "may result in significant and possibly major long-term changes of the global-scale climate."

In 1981, Jim Hansen of NASA's Goddard Institute for Space Studies in New York predicted that, considering how fast CO2 was accumulating in the atmosphere, "carbon dioxide warming should emerge from the noise level of natural climatic variability" by the end of the 20th century.

Other scientists agreed. The discovery of global warming – that it to say clear evidence that the greenhouse effect really did act in the manner predicted by climate scientists – would be plainly obvious to everyone on Earth by 2000.

In 1985, American Wally Broeker and two colleagues published definitive evidence that the world-spanning movement of seawater is driven by differences in heat and salinity and predicted that higher atmospheric concentrations of carbon dioxide could alter those currents completely disrupting global weather patterns.

In 1988, the United Nations created the Intergovernmental Panel on Climate Change (IPCC). Climate science becomes a new force in world affairs. The concentration of carbon dioxide in the Earth's atmosphere reaches 350 parts per million.

In1990, the Intergovernmental Panel on Climate Change released its first assessment which offered that the amount of global warming was broadly consistent with predictions of climate models but also of the same magnitude as natural climate variability.

In 1992, the global Framework Convention on Climate Change was created with the objective of stabilizing "greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system … within a timeframe sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner."

In 1994, the Framework Convention on Climate Change came into legal force in all the nearly 190 nations that ratified it – including Canada and the United States.

In 1996, the second assessment of the Intergovernmental Panel on Climate Change reported that the balance of evidence suggested a discernable human influence on global climate.

In December of 1997 the Kyoto Protocol was signed with the aim of negotiating binding national greenhouse-gas emission limits. The Kyoto Protocol remains largely unimplemented and negotiations surrounding it have largely broken down.

In 2001, the third assessment of the Intergovernmental Panel on Climate Change reported that there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities.

It is now 2006. There are about 750 million cars and trucks in the world. We burn 80 million barrels of oil a day. Imagine all those millions of little engines heating up the world and then emitting carbon dioxide so that the greenhouse effect will make the world even warmer for decades to come.

By 2030, global demand is expected to reach 140 million barrels a day. At the same time natural gas consumption is projected to increase by 120% and coal consumption by 60%.

As a consequence, human contribution to carbon in the atmosphere have risen from a paltry hundred million tons a year in the 1700s to near seven billion tons a year today, double what the biosphere can easily absorb. Presently carbon dioxide concentrations are at about 370 parts per million, up about 27.6% since John Tyndall first speculated on the importance of carbon dioxide to atmospheric temperature way back in 1859.

Given the momentum of our current energy economy carbon dioxide release will hit 12 billion tons a year, or 520 parts per million by 2030 and more than 20 billion tons a year, or 1100 parts per million by 2100.

As effective energy alternatives are only in the development stage, we are, whether we like it or not, wedded to petroleum as the foundation of our energy economy for the next decade or more.

That means it will take at least a generation before we can seriously begin to mitigate climate change impacts. During that period we have no choice but to watch the world heat up and live with the consequences.

If, as a society, we have decided that we will not mitigate human impacts on climate change, then we have no other option but to adapt to the world we are in the process of creating. This means that we will have to perform for ourselves many of the functions that nature used to perform on our behalf.

A whole new global economy is about to emerge to provide the environmental services that nature at one time reliably provided free on our behalf. The taking over of planetary

ecosystem management from nature will create the biggest industry that has ever existed in human history. The sheer scale and urgency of the project will require this to be so.

If managing nature is our objective, we need to take a clear-eyed view of the causes of climate change and why we need to be concerned about them. On the positive side, we now know more than ever about the complexities of climate and climate change.

Once we have had an honest look at the problem, we can decide how to act. From this workshop it is possible to summarize what scientists who have presented here believe to be true about our climate situation from what is presently known in scientific circles I trust. While not everyone may agree, following are ten things that could form a reasonable foundation from which to view the directions we move in order to adapt to what is happening to the world we thought we knew.

1. Our climate is a highly sensitive, global telekinetic system that has taken the better part of our planet's history to evolve. Human reactions to that sensitivity are local and linear.

2. After more than 150 years of speculation and research, we now know that glaciations and a number of other climate patterns are caused by the combined cyclic effect of orbital eccentricity, tilt and planetary precession over time. In addition to orbital geometry and volcanic eruptions, other geological processes also play a measurable role. These affect climate, certainly, but so do humans.

3. We now know that it is possible that humans have been impacting climate since we began forest clearing 8000 years ago. This impact was accelerated when humans began practicing large-scale agriculture some 3000 years later.

4. Out of the background of orbital, natural and cyclical climate effects, it has become apparent that significant human impact on the composition and dynamics of the Earth's atmosphere began with the Industrial Age and has accelerated to this day.

5. It is quite possible we have prevented natural cooling and actually forestalled the beginning of a glacial period by way of our own activities.

6. We have altered the Earth's atmosphere. It is estimated that in the last century we burned 875 billion barrels of oil. We have dumped half a trillion tones of carbon dioxide into the Earth's atmosphere in only 25 years. At projected rates of growth, we will add another trillion in the next quarter century. Despite contrarians who would wish it otherwise, if you put that much stuff into the Earth's atmospheric soup, one should not be particularly surprised if something happens.

7. Something is happening. Our activities are having a growing impact which is irreversible, at least in the short term, in effect. Because planetary systems cannot absorb CO2 at this rate, the CO2 we put in the atmosphere in the next 25 years

will still be heating the Earth centuries from now. The fear is that ultimately we may find ourselves in the situation of destabilizing or even uncoupling atmospheric dynamics that have taken millions of years to develop.

8. It is not just our direct impacts that we have to understand but their consequences. Our direct impact on climate is small compared to the catastrophic feedbacks we are starting to cause, especially related to the potential large-scale release of methane from the world's oceans, permafrost and peat-lands.

9. We do not at present have the knowledge, the organizational capacity internationally, nor the economic means to take on the responsibility of managing the planet's climate on a global scale. But if we don't want to mitigate these impacts, we may have to.

10. We need to know a great deal more so that we don't cause unnecessary suffering in our time or make the world less habitable for future generations.

Each of us needs a tangible place to start addressing the problem – and since all of us love mountains we should start there. In imagining the impacts of climate change, think of where the dawn's light first strikes at the beginning of the day. It strikes the tops of mountains. When you think of climate change, think also of where the sunlight touches the Earth most persistently and that is where twenty-four hour light falls on the poles.

It is to these places we should look first for the most pronounced and immediate evidence of how climate change has begun to alter our world. It is also to these places, and to the people who care most about them, that we should turn for effective public policy with respect to both mitigation of climate-altering impacts and appropriate adaptation to changes that are now beyond our control. Pioneering precedents within this community demonstrate that mountaineers have both the knowledge and the experience necessary to contribute significantly to the shaping of public attitudes about climate change in alpine regions.

One of the questions this workshop was created to answer was how do we do that? How does a volunteer organization like the Alpine Club of Canada orchestrate and utilize its limited resources and energy in such a way as to make a positive difference in addressing what is in reality a problem of truly global dimension. To that end I would like to offer ten steps toward Alpine Club of Canada public policy influence on climate issues that affect the Canadian alpine.

1. Make It Personal: Recognize what the threat means to mountains and mountaineers and commit to action

A century after one of Europe's best known mountaineers laid down the foundation for modern climate science, the UN's Intergovernmental Panel on Climate Change is predicting a projected mean annual global atmospheric temperature increase of between

1°C and 6°C in the coming decades. Evidence of these changes is already becoming obvious in Canadian mountains.

It is surprising how long it is taking for the mountain community in Canada to wake up to the magnitude of the climate change threat.

One quarter of the glacial mass in the Canadian cordillera has disappeared in the last century. Climbing routes on Rocky Mountain glaciers are now changing faster than guide books can keep up. Many climbers are also observing dramatic changes in the amount of rockfall on many routes as higher temperatures melt the ice that holds broken rock to the mountainsides.

Even more troubling are reports offered by glaciologists like Shawn Marshall and others of the unexpected extent of glacial recession that took place over much of the northern hemisphere during the unusually hot summer of 2003. In that single summer, one of the hottest on historical record, 10% of Switzerland's glacial mass disappeared.

What we learned from this is that it is entirely within the domain of possibility that glacial recession could accelerate beyond current rates. It may be that ours will be the generation that says goodbye to the mountain cryosphere. We can only begin to imagine attendant impacts.

While many mountaineers might prefer to simply keep climbing, the changes that are taking place in the world's alpine regions are likely to be of such magnitude that they will be impossible to ignore.

As these impacts manifest themselves, they will much reduce the domain mountaineers have largely held to be their own. Presently two-thirds of the roughly 24,000 square kilometre mountain region protected as part of the UNESCO Canadian Rockies World Heritage Site is composed of bare rock, scree and ice. Under current projections that could change. Forests have already begun to advance upward.

Climate change of the order that is presently projected could cut the amount of alpine in this region by at least half. If this was your country, and you a citizen, would you permit development that took half your country away? Is there anyone in the Alpine Club of Canada who wants to have to climb to 9,000 feet to get into the alpine?

The issue might also be put another way. You are a mountaineer. You are climbing on a steep wall on a rope with three others for whom you care a great deal. One is your wife, one is your daughter and the other is your son. You are below the exposed face of the mountain. Suddenly a boulder is dislodged above and you notice it skipping and shattering into fragments that are falling toward you.

Given the vulnerability of your rope it would be mad to say, "don't worry, you don't even have to think about it — I just read a novel that said that rock fall isn't happening, and to the extent that is, it is perfectly natural. What would your children say if you just dismissed the threat? "Hey, don't worry, the rockfall is not coming toward us."

How would your family judge you if you said, “We didn’t sign any international agreement that would permit rockfall of this kind, and even if such an agreement were to come into existence, we could not permit its use or application to be employed in consideration this or any other related problem”?

How would your children’s children respond if you were later quoted as saying at that moment, “I didn’t personally dislodge the boulder so it’s not my problem.” “It wasn’t me!”

O.K. If that analogy doesn’t work for you, try this one. You have got a fever. It is getting worse. How long can you go before you go to the doctor? How sick do you have to become before you do something about it? How sick do you have to become before you can’t do anything about it?

We have the capacity to do something about it. Let’s do it.

2. Get the facts and share them: inside and outside the club

At present, we don’t know what to do. But, to be fair, we really haven’t thought much about it. At present the Alpine Club of Canada is not lined up to think about it. But this workshop could change that.

It has become very apparent in examining the history of this club over the past century that its focus has changed dramatically. When the club was conceived, its focus was much broader. Because the entire field of mountain knowledge and aesthetics was completely open in 1906, the founders took pains to cover all the bases. While recreation in the form of climbing was the central focus, it was made clear that art, science and environmental concerns were of equal importance to the successful development of a home-grown mountain culture in Canada.

In time, however, the art focus of the club was appropriated – as it should have been – by professional artists who took up mountain themes as subjects for their work and by galleries and museums. Limited as it was by the research techniques and challenges of the day, it is not surprising that the club’s science focus was soon appropriated by universities and specialized research institutions. The club’s environmental focus was similarly taken up initially by the National Parks Association, which the club helped form, and then by the huge number of new environmental organizations that came into existence as the global environmental movement gained momentum in the 1960s and 1970s.

The ACC of today has, in effect, become a not-for-profit recreational corporation committed to the facilitation of satisfying member access to shared experience and facilities in mountain or mountain-like areas across Canada. After a near death in the 1970s, the club has recovered. But the future is far from certain.

Canadian populations are growing. Other organizations similar to the ACC have sprung up and are drawing members away. Access and environment issues are already becoming more and more complex. Then there are emerging issues like demographic shifts and climate change. With changing climate, the crowded lowland circumstances that ACC members climb to escape are likely to move up in altitude.

Climate issues, if not carefully addressed, could in combination with demographic shifts erode the foundation of the club's purpose and impact the size of its membership. In order to protect its assets and membership base and to be relevant in the future the club may have to reaffirm its original commitment to both science and environmental advocacy.

As ACC Secretary Peter Muir so eloquently pointed out, re-energizing the scientific and environmental domains is not going to be easy. For all our passion about mountains, the membership of the club – and even its executive – is divided over the climate issue. In essence the Alpine Club of Canada is not any farther ahead than the general public in either understanding or appreciating the significance of the climate change threat. But we need to agree on what we are going to do. Before we try to change the rest of the world, we have to work on ourselves.

The club's own membership is its first and most important public policy constituency. Nothing can be done with respect to climate change without engaging the club's membership. Nor will anything be possible without a new strategic executive focus on the issue and appropriate organizational redirection.

Workshops like this are a very good start. Initiatives like the UIAA Protected Areas Melting Glaciers Project offer excellent direction. But these programs are just a start. As Isabelle Daigneault said in her presentation, we need to demystify climate issues.

3. Build a functional bridge between science and membership understanding

Referring once again to his very thoughtful presentation on what frogs and space walks tell us about separating issues related to access and environment, Peter Muir posed a very significant question. "… for the privilege of mountaineering," he asked "do we not carry with us the obligation to bring back the message that the world is changing? Are we not required to learn what we can?"

Peter went on to offer that "Our debt is to determine why that world is changing and in what respect we, both in our mountain craft and in our daily lives, can by example, lead to changes in the daily practise of life by us and by others."

Peter concluded his paper by suggesting two minimum obligations to which the club could commit in order to serve both the environment and the ultimate interests of its members.

In order to become awe-inspired space walkers rather than frogs boiling ourselves in indifference, the ACC should provide learned, tested and intelligible information to assist its members and the public to understand climate change issues.

The club should also demonstrate the best environmental practices to the fullest possible extent in all aspects of its operation. As we all know, much has already been done in this domain.

In essence, Isabelle Daigneault, Vice President of Access and Environment, and her two University of Calgary colleagues, Tara Moran and Kate Sinclair, spoke to both of Peter Muir's proposals.

Their preliminary ideas on mechanisms for gathering, reviewing, interpreting and sharing the latest and best science among the club's membership count among the most exciting things I have heard in the thirteen years I have been on the executive of the ACC.

Their presentation makes it very obvious that we can build an effective bridge between science and membership understanding on issues related to climate change. All we have to do is want to.

4. Harmonize club activities and programs with climate action goals

As has already been mentioned, the Alpine Club of Canada is well situated from an operational point of view to face future circumstances related to climate impacts.

The Environmental Management Commitments articulated by Karen Rollins for the Alpine Club of Canada are among the clearest and most succinct I have ever seen.

The strategies for sustainability in the operation and use of the club's mountain huts – as presented by Dr. Hannigan – are among the very best in the world. Certainly they respond well to the UIAA Environmental Objectives and Guidelines that were set out in 2002.

Of all the club's portfolios, perhaps Facilities is best prepared by virtue of its own organization and focus to think its way toward the future with respect to climate impacts.

With their knowledge of their own human use impacts, they are able to project climate circumstances forward in time to determine what positive and negative impacts could have a bearing on membership value and on revenue generating activities of the club. They are in a position to ask some very important questions.

If, for example, glaciers retreat dramatically, treeline rises and summer hiking seasons are extended, what impact might there be on the attractiveness of the club's hut system? What modifications to membership offerings should accompany greater potential visitation to what for us was the high alpine but for future generations could simply be a limited extension upward out of rapidly developing forest ecosystems?

To what extent could the club's capacity to interpret these changes over time be an impetus for new kinds of membership?

To ensure the club's enduring relevance, to what extent do climate change issues demand a refocusing of the club's energies and activities back to its original scientific and environmental mandates?

5. Establish an ACC climate agenda

As Isabelle Daigneault, Kate Sinclair and Tara Moran insisted, we are not helpless. The key success factors they put forward can be a template. To be successful in address the larger climate problem, however, mountaineers have to think beyond activities and facilities. The Alpine Club of Canada has to decide if it wants to seriously address the climate change issue within its expanded mandate and function. This cannot be an executive decision passed from the top down to sections and members. A carefully orchestrated dialogue will be necessary at all levels of the club.

The only way such a dialogue will be meaningful will be if an education program offering members the most current knowledge and perspectives about climate issues in Canada's mountains precedes the club's decision to take this matter on in a serious manner. Only after this dialogue has been undertaken and a practical climate agenda established can the club begin to define the political domains in which it will be practical to seek influence.

It should be appreciated from the outset that such an initiative could be highly influential in bringing the diverse sections of the club together under positively altered circumstances with a common goal that could strengthen the club and bring new members and interests into its fold. It should also be recognized that there will be some push-back, from members and from the public. It will be important to say focused on what the ACC has the resources and energy to do.

6. Understand and appreciate current misunderstanding and expect resistance

The evolution of effective public policy related to climate change in Canada has been hampered by doubt that has been manufactured around the validity of the threat. Many Canadians allow themselves to be lulled into complacency by a quiet but very aggressive but in-close public relations misinformation campaign that would have us what we see happening right in front of our eyes. As a result of the confusion generated around the issue, people don't know what to do and they don't know who or what to believe.

Most Canadians and many Alpine Club of Canada members believe, quite simplistically, that it wouldn't hurt at all if the climate in Canada was a little warmer. While that is certainly true that the warmer winters we are enjoying are very pleasant, what is being missed in the climate debate in Canada – if such a debate actually exists in these

conservative times – is that most of us don't have any idea of the extent to which our society and its evolution have been a product of relative climatic stability.

There is now enough new information to believe this is no longer true. While we cannot predict the exact rate and timing of projected changes, we do know that if these changes occur, the past will no longer be a guide to the future. Most Canadians has yet to understand the significance of this.

There is also a demographic dimension to the contemporary denial of the seriousness of the climate change issue. There is presently a huge bulge of 50+ people like myself in our society and it is they who currently determine the social, economic and political agenda on our continent. They are perhaps ambivalent about climate issues because they feel the impacts that have been projected are exaggerated and cannot possibly manifest themselves during their lifetimes.

Climate change – for the moment at least – is an "out of sight – out of mind" issue for most North Americans. The most profound of climate change impacts at least in terms of temperature are occurring – at night and in winter – when most of us aren't looking.

Another issue is the complexity of this problem – and in particular the difficulty in separating climate impacts from other human influences and natural cycles. Climate science is finicky, demanding and difficult to grasp.

On top of all this there is the problem of climate change being put forward as an environmental issue by environmental activists and lobbies. A large proportion of our North American population is tired of this lobby and their self-righteous whining and Chicken Little whimpering about all the evils of contemporary society.

Environmental motives are seen as political agendas. We've all heard it. "If environmentalists are saying the climate is changing, then I'll be damned if I will accept that it is." As both an historian and an ecologist, I must admit I find this very interesting. You find yourself on a narrow railway bridge that spans a chasm between two historically significant periods in human history. A train is approaching. It doesn't appear to be approaching quickly but you are not sure. Do you spend your time arguing whether it's a freight or a passenger train or do you get off the bridge and off the track?

Because we are grounded in mountain place, we can bring new perspectives to debates over both the nature of the train and the direction of the track. There is considerable opportunity for the ACC in this.

7. Recognize and bridge the difference between positive and normative claims

What we have created with respect to climate change in Canada could be described as the Al Capone School of Public Policy. This is a school of public policy defined by the gangster maxim that if "Nobody moves, nobody gets hurt".

You can talk all you want but don't you dare move. And while we remain motionless, we are creating problems for ourselves faster than we can solve them.

If there is one thing that stands in the way of truly integrated approach to climate issues in Canada, it may reside in the fact that jurisdictions often isolate themselves and affected interests do not always share information or collaborate effectively on better solutions that serve the long-term common good.

Another reason that Al Capone remains on the loose is our failure to build a reliable and durable bridge between science and public understanding that results in effective public policy. Perhaps like you, I think and act very differently around scientists than I do around people with political motives or intentions. One lives in a fact-based world; the other in a world in which facts matter far less than consensus. Say "good morning" to a scientist and she is likely to check her watch. Say "good morning" to a politician and he is likely to look around to see if everyone agrees. Their motivations and methods of discourse are so very different, no wonder they have trouble talking.

Let's start with scientists. Scientists gain academic and professional status by advancing shared knowledge. They often pursue knowledge purely for knowledge's sake. They also gain status by being cautious in interpreting new knowledge claims and for their fairness in evaluating the validity of competing claims. While there are real disagreements and often bitter rivalries in scientific debates, advancing knowledge is seen to benefit science as a whole. Compare this with politics. The principal goal in politics is not necessarily the common good, but the gaining and holding of power. In political circles status is gained by those who can make sure that one individual's or group's gain <u>is</u> at the expense of another.

Even when an issue like climate begs to be examined in the light of the highest good, competitive elements can still very much define policy decisions. In vigorous political debate it is quite common to hear exaggerated and biased claims. Emotional appeals and personal attacks are the stock and trade of political debate. It ain't pretty but that's how politics work. Even when the appropriate scientific course is right before our eyes, truth may not win out if you find yourself up against a rhetorically skilled opponent who operates – not by the rules of science – but by the much different and far less constraining rules of political debate.

Science is not likely to change, nor is politics. We need to build a better bridge between them or we are not going to get where we want to be. In every single Canadian community I have visited there are people who are trying to make things better. But where there are problems exist there are always the same. I want to make clear, at this point, that, in my opinion at least, the enemy is not growth.

The enemy is our habit of continuously delaying action on crucial issues like climate until further growth has satisfied what are perceived to be more urgent demands.

Many believe that because Canada is a wealthy country with seemingly endless resources and millions of well educated people that it is impossible for us to make the mistakes previous civilizations have made in the management of their resources. But our record is not exactly perfect.

I invite you to consider the Atlantic cod fiasco. Some of the causes of the Canadian cod fishery collapse have been identified and they are very relevant to the debate we are having in this country over climate issues. They include the fact that almost everyone thought the resource inexhaustible; private interests demanded to be served before the real issue was addressed; federal and provincial governments warred over jurisdiction so no organization could claim charge; government departments suppressed information; scientists who offered dissenting views were discredited and short term political gains were put ahead of the sustainability of the fishery. An environmental catastrophe became an economic and then a social disaster. The worst thing is that we didn't learn anything from it. Five years after a moratorium on fishing was imposed, the stocks still show no sign of recovering. And yet we still allow people to fish.

We literally can't afford this to happen with climate change.

8. Build effective partnerships with organizations with similar climate-related needs and agendas

It is now known that even small changes in global mean temperature will have a profound effect on alpine ecosystems. A recent Environment Canada report on climate impacts on Canada's national park system, for example, indicated that mountain vegetation zones in the Canadian Rockies are expected to shift upwards by approximately 500 to 600 metres or a range of about 1600 to approximately 2000 feet, the equivalent of one vegetative zone in any given mountainous region.

Alpine plant and animal species are predicted to be driven upward and northward into oblivion. These changes are expected to accelerate as greater concentrations of carbon dioxide and other greenhouse gases absorb more heat and warm our atmosphere.

As whole ecological systems advance northward and upward it is anticipated that current ecological communities will begin to disassemble and re-integrate into new assemblages. The Canadian West will be a different place by 2050.

This presents what has been described as the greatest challenge that our national park system has ever faced. For the last century, the strategy for protecting global biodiversity has been to protect representative parcels of each important eco-region. The foundation of this entire global program, of which our mountain national and provincial parks are an important part, is that these representative areas will remain biogeographically stable.

A great deal of contemporary research indicates that global climate change impacts are already invalidating this assumption. Park managers are justifiably worried that national parks will no longer exist within the geographical domains they were created to represent.

The future maintenance of global biodiversity will require us to aim to protect what will effectively become "a moving target of ecological representativeness".

Protecting existing landscapes will require that disturbances be managed, new stresses will need to be controlled, and habitat modifications will likely be necessary to reconfigure protected areas so that they can survive emerging climate conditions. In such a context, biodiversity managers will have to figure out how to become "creation ecologists" as they learn to adapt to change.

It is not inconceivable that park managers may ultimately be charged with management of many of the fundamental processes that nature presently provides free on our behalf but that would no longer be provided under certain climate change scenarios. It is not impossible that in the future wilderness areas will be managed toward defined goals of production of air, water and species diversity, complete management of both surface and groundwater, integrated management of energy, water and product inputs and outputs of agriculture and forestry; the control of the composition, nature and behaviour of the Earth's atmosphere; and the careful direction of global ecosystem change.

These developments are going to generate huge challenges for our already existing protected places partners such as Parks Canada and provincial park administrations. Eventually Parks Canada and our provincial park friends are going to need help with this. The Alpine Club of Canada could serve its membership and its mandate by becoming partners with these agencies in addressing climate related ecosystem and human use issues. As partners in sustaining biodiversity and managing human use in Canada's mountain regions, the Alpine Club of Canada could make a huge difference to the future of this country's mountain regions. We did it once, we could do it again.

9. Carefully and respectfully build public policy bridges at influential local, regional and national levels.

The widespread pretence that current disagreements over climate change policy have arisen from disagreements about the state of scientific knowledge has allowed policy makers at both federal and provincial levels in Canada to avoid dealing with their real responsibility, which is to engage in questions of political values in view of the present state of scientific knowledge in order to determine what, as a society, we should be doing about climate-related threats and opportunities.

If the Alpine Club of Canada wants to have an influence on the evolution of public policy with respect to climate issues, it must be clear in its objectives and correct in its interpretations of impacts on mountain regions. Because of its limited resources and reliance on volunteers, it will also have to be very strategic in the manner in which it orchestrates it public policy efforts.

As indicated earlier, a carefully considered ACC climate agenda will be required first to motivate club members to take the issue seriously and then to ensure that the club's

claims and recommendations are credible in those political domains in which it might seek influence.

As has already been noted, it is counter-productive to just do the science and then say, "Here it is, it is done". Careful interpretation of climate science related to impacts on mountain regions is crucial to success in advancing public policy toward ends that satisfy the club's membership interests.

It is also crucially important that the club does not take biased, simplistic or atomized approaches to public policy. It will be important that section strategies and actions are synchronized with the club's national agenda.

The club should also recognize that even carefully considered policy recommendations do not always succeed in being considered in policy debates. Intervener contributions fail in many ways. Some assessments lose credibility by making explicit policy recommendations or otherwise going beyond their authoritative expertise. Others are unsuccessful because they fail to synthesize present knowledge in a coherent way.

When policy recommendations succeed it is usually because they have managed successfully to bridge the boundary between scientific and political debate. There is no single model of how to do this, but it is clear that the most successful political influence is held by those who are trusted and who know what questions should be asked to arrive at what decisions to favour.

I should point out, however, that we have done this before – and very successfully, too. We did this in the first two decades of the club's existence when we helped the Canadian government master the unprecedented challenge of creating a national park system in this country. There is no reason we can't do for climate what we did for our protected places system. We can raise the call, define the course, and then invite others to take up where we started and do better.

10. Embody our society's need to be positive and persistent while being flexible and adaptive.

Besides being members of the Alpine Club of Canada, we all have professional, community and family lives. Our knowledge of mountain geography and ecosystems allows us – as Peter Muir also mentioned – to be highly influential witnesses to climate impacts in our time and to extend that influence beyond the mountain community to everyone around us.

It will not just be our knowledge of mountains, however, that will influence others. Our trustworthiness as guides in this issue will be determined the extent to which we can all summons the qualities of character and personality that we so admire in those who have been granted grace by a life long exposure to mountain places and people.

It is important we be unfailingly considerate and positive in our outlook on our climate future. It is also important that we be flexible and adaptive to changing circumstances in the same way we would be on mountain. We also need to recognize always the complexity of the issue and the crucial importance of keeping up with science and with unfolding events related to understanding of climate impacts on our mountains. Finally, we need to be persistent, as we would be on any mountain, if we want to achieve our goal.

In Conclusion

When the great Irish physicist and mountaineer John Tyndall deduced the heat-absorbing role of carbon dioxide in the atmosphere, it only deepened his great appreciation for the wonders of the world spread out beneath him as he peered down on the glory of this extraordinary planet from the summit of the Weisshorn.

Tyndall would not have us believe then, nor would he have us believe now that the sky is our enemy. Look to the mountains, he would say – listen and watch. In the matter of climate change impacts on our world, we should be guided by our experience of our own mountains.

The only threat we face – the only one that could really undo us - is our habit of continuously delaying action on crucial issues like climate until we have finished doing other more enjoyable things. We would be wise to listen to what the mountains are telling us and act before it is too late. Climate change is upon us. I believe the Alpine Club of Canada can, and should, make a difference in addressing its impacts.

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Vice-President, Mountain Culture
The Alpine Club of Canada
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ACC Workshop on Climate Change in the Alpine
October 10-11, 2006, Banff, Alberta

Talk Outline: Ten Things to Know About Glaciers and Climate Change

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1. Mountain glaciers are way out of equilibrium with present-day climate. Small glaciers will continue to disappear and larger glaciers and icefields will retreat to make a last stand at higher altitudes.

2. Glacier retreat is global; all of the world's mountain and polar regions are groaning, cracking, and dripping to life.

3. Current changes and rates of change cannot be explained by natural climate forcing. The footprint of human-induced climate change is clear. Indeed, given the way that humans have modified the atmosphere, it would be strange if the Earth was not warming. We have become a geological force that is altering Earth's weather and climate. There is no real debate about this question any more.

4. We don't really know the story in the alpine, at least in Canada. Are we seeing less snow at high altitudes? Is the high-altitude warming amplified?

5. We don't really know how long the glaciers will remain with us. This varies from glacier to glacier and it depends on the temperature and snowfall forecasts at a site. But the last time it was this warm….

6. For glacier mass balance, temperature changes almost always trump changes in snowfall. There are a few places where increases in snow accumulation have offset warming, extending the life of glaciers. Western Canada is not on this shortlist.

7. Almost all of the feedbacks in glacier retreat are positive: that is, warming and retreat beget accelerated retreat. Examples from Greenland and the Rockies.

8. Mountain glaciers don't matter much for global sea level, although there is collective present-day contribution of some 0.4 mm/yr. Now the Arctic is another story….

9. Mountain glaciers do matter to water resources, particularly in late-summer. They act as natural reservoirs and 'emergency' water supplies in dry years. Glacierized area is key – as landscape elements, glaciers supply ~5 times more water per km^2 than unglacierized areas that feed Alberta's rivers. This supply diminishes as the glaciers disappear from the landscape. We are already past peak water.

10. The mountain snowpack matters a great deal for water resources, and the glaciers are a part of that. They are extremely effective snowtraps, accumulating snow at a ratio of ~16:1 relative to lee-slope sites such as Banff and Calgary, and ~2:1 relative to adjacent alpine sites.