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MYTH 1: THERE IS NO SCIENTIFIC CONSENSUS

The overwhelming majority of scientists are in agreement about the following fundamental assertions: 1) the world has been warming and will continue to warm for the foreseeable future, 2) the warming is largely due to human activity (burning fossil fuel - oil, coal and gas - and destroying forests), and 3) the consequences of rising temperature, in all projected futures, are grave enough to warrant global action.

How do we know this? In 1988 the U.N. established the Intergovernmental Panel on Climate Change (IPCC). This is a body of over 2000 scientists and experts from around the world who gather periodically to review the existing peer-reviewed literature of the relevant science. The skeptical scientists, by the way, are invited and are even among the lead authors of working groups. The summary documents are reviewed *word for word*, with industry and skeptics in the room. The IPCC's methods are rigorously fair to dissent, and incomparably thorough. The IPCC only began to assert the fundamentals in 1995 and since then has increased the conviction of the wording in its summary statements.

To add to this unprecedented overall agreement of the world's scientists, a statement endorsing the legitimacy of the process and the conclusions of the IPCC has been signed by 16 national scientific societies (<http://www.royalsoc.ac.uk/policy/index.html> -> Search: IPCC -> The Science of Climate Change):

THE SCIENCE OF CLIMATE CHANGE

A joint statement issued by the Australian Academy of Sciences, Royal Flemish Academy of Belgium for Sciences and the Arts, Brazilian Academy of Sciences, Royal Society of Canada, Caribbean Academy of Sciences, Chinese Academy of Sciences, French Academy of Sciences, German Academy of Natural Scientists Leopoldina, Indian National Science Academy, Indonesian Academy of Sciences, Royal Irish Academy, Accademia Nazionale dei Lincei (Italy), Academy of Sciences Malaysia, Academy Council of the Royal Society of New Zealand, Royal Swedish Academy of Sciences, and Royal Society (UK).

The work of the Intergovernmental Panel on Climate Change (IPCC) represents the consensus of the international scientific community on climate change science. We recognise IPCC as the world's most reliable source of information on climate change and its causes, and we endorse its method of achieving this consensus. Despite increasing consensus on the science underpinning predictions of global climate change, doubts have been expressed recently about the need to mitigate the risks posed by global climate change. We do not consider such doubts justified.

There will always be some uncertainty surrounding the prediction of changes in such a complex system as the world's climate. Nevertheless, we support the IPCC's conclusion that it is at least 90% certain that temperatures will continue to rise, with average global surface temperature projected to increase by between 1.4 and 5.8°C above 1990 levels by 2100. This increase will be accompanied by rising sea levels, more intense precipitation events in some countries, increased risk of drought in others, and adverse effects on agriculture, health and water resources. [*Statement truncated*]

Readers might notice that the US National Academy of Sciences is not on the list. But read below to see that its position is that of the IPCC.

It's been said that getting scientists to agree on much is like herding cats. We recommend you keep this in mind when putting the present day level of general agreement in perspective.

Yes, there are contrarians. There always will be. But there aren't many of them and a significant fraction of these are supported directly or indirectly by the fossil fuel industry. Just as in the case of the smoking-cancer link, there will always be "experts" who support the self-serving industry position and deny the science.

Unfortunately, the stakes in global climate change and the fossil fuel industry are even higher than they are with tobacco and cancer. The planet's climate is at stake.

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MYTH 2: AMERICAN SCIENTISTS DON'T BUY IT – 19 000 SIGNED A PETITION AGAINST THE IPCC'S VIEWS AND THE NEED FOR THE KYOTO PROTOCOL

The petition is a hoax. According to the [Union of Concerned Scientists of the USA](#):

In the spring of 1998, mailboxes of US scientists flooded with packet from the "Global Warming Petition Project," including a reprint of a Wall Street Journal op-ed "Science has spoken: Global Warming Is a Myth," a copy of a faux scientific article claiming that "increased levels of atmospheric carbon dioxide have no deleterious effects upon global climate," a short letter signed by past-president National Academy of Sciences (NAS), Frederick Seitz, and a short petition calling for the rejection of the Kyoto Protocol on the grounds that a reduction in carbon dioxide "would harm the environment, hinder the advance of science and technology, and damage the health and welfare of mankind."

The sponsor, little-known Oregon Institute of Science and Medicine, tried to beguile unsuspecting scientists into believing that this packet had originated from the National Academy of the Sciences, both by referencing Seitz's past involvement with the NAS and with an article formatted to look as if it was a published article in the Academy's Proceedings, which it was not.

The NAS quickly distanced itself from the petition project, issuing a statement saying, "the petition does not reflect the conclusions of expert reports of the Academy."

The petition project was a deliberate attempt to mislead scientists and to rally them in an attempt to undermine support for the Kyoto Protocol. The petition was not based on a review of the science of global climate change, nor were its signers experts in the field of climate science. In fact, the only criterion for signing the petition was a bachelor's degree in science. The petition resurfaced in early 2001 in a renewed attempt to undermine international climate treaty negotiations.

In fact, American experts agree with the IPCC on its fundamental assertions:

In the summer of 2001, George W. Bush asked for the assistance of the US National Academy of Sciences “in identifying the areas in the science of climate change where there are the greatest certainties and uncertainties,” and for its “views on whether there are any substantive differences between the IPCC Reports and the IPCC summaries.” The NAS was given only a month to respond but did so nonetheless:

[Climate Change Science: An Analysis of Some Key Questions](#)

Despite the fact that the committee producing this report includes a notable skeptic who allegedly colludes with industry* (Dr. Richard Lindzen of M.I.T.), the NAS report states:

"The IPCC's conclusion that most of the observed warming of the last 50 years is likely to have been due to the increase in greenhouse gas concentrations accurately reflects the current thinking of the scientific community on this issue. ... Despite the uncertainties, there is general agreement that the observed warming is real and particularly strong within the past 20 years" (p.3).

For further publications of the NAS see:

[Abrupt Climate Change: Inevitable Surprises](#) (2002)

[Under the Weather: Climate, Ecosystems, and Infectious Disease](#) (2001)

The reader is invited to visit the Union of Concerned Scientists' [website](#) for an excellent summary of the skeptic organizations, their tactics, and other hoaxes such as the so-called Leipzig Declaration.

* Lindzen calls himself an “independent scientist” and consults for the fossil fuel industry at a rate of US \$2500 a day (Sharon Beder, Corporate Hijacking of the Greenhouse Debate, *The Ecologist*, March/April 1999, pp. 119-122.)

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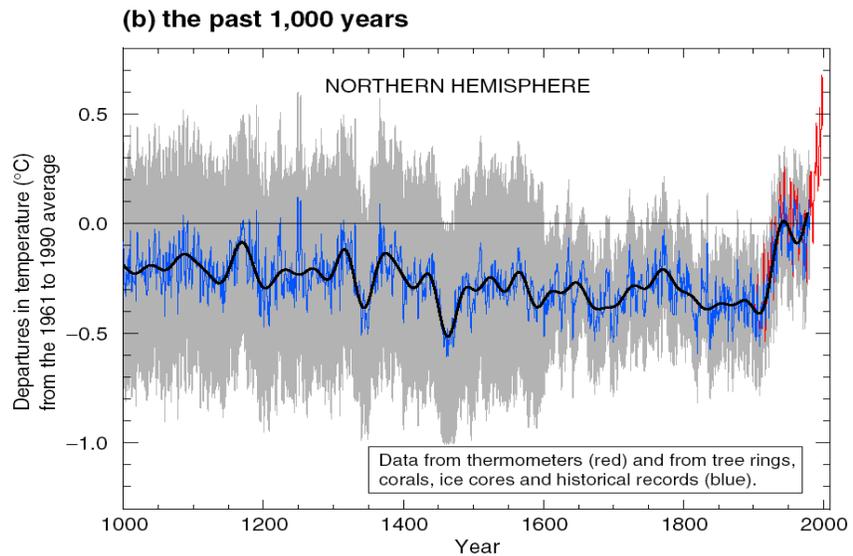
MYTH 3: THIS IS ALL WITHIN NATURAL VARIABILITY

There are several ways to impress upon people that this is false. One could first point out that the thousands of scientists would obviously have taken this into account when doing the statistics.

It is also important for people to know that the data extends further back than the approximately 140 year-old thermometer record. Using indirect measures from sources such as ice cores from the poles and tree rings from ancient forests, scientists can make excellent guesses about the baseline temperature trends.

When they look at this kind of data they say that the average global temperature has most likely never been this high for at least 1000 years and the atmospheric concentration of the greenhouse gas CO₂ has not been this high for 420 000 years and likely never this high over 20 million years.

For those who like to read graphs, the ‘all within variation’ notion is countered in part upon viewing the following IPCC graph. You’ll note that there was a slight downward trend until the early 1900’s at which point there was a massive upswing in average global temperature. The present level (in red) is higher than the 95% error or uncertainty range depicted in grey. This error is larger prior to the thermometer data in red at which point it becomes much less broad. The *rate* of average temperature increase in the last century is unprecedented in the past 1000 years.



Source: [IPCC](#), Working group I, Summary for Policy Makers (SPM), Third Assessment Report (TAR), page 3.

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MYTH 4: IT WON'T AFFECT CANADA AS MUCH – AND DEFINITELY NOT IN MY LIFETIME

Unfortunately for Canadians, the effects of climate changes are predicted to be *greater* in our region of the world. While the global average temperatures, for example, should go up from about 2 to 6 degrees Celsius by the end of the century the Canadian average will be within the 6 to 10 degree range.

What some mean when they say we won't be as affected is that we are rich enough to adapt. That is, we can afford air conditioners, we can build dykes to barrier off the rising seas, we can pay for insurance when our crops dry up or our forest fires increase and so on. This is an irresponsible if not ignorant attitude.

Already in Canada's North the Inuit are seeing a novel red-breasted bird for which their ancient language has no word - the robin. Residents of Sachs Harbour on Banks Island have seen the permafrost melt and witnessed an unprecedented event - a thunder and lightening storm. The ice is thinning, as are the polar bears.

Last year the federal government spent \$5 billion in aid to prairie farmers due to drought. The B.C. [government](#) expects infestations of the spruce pine beetle to increase in severity and frequency as their numbers are not lowered by warmer winters. The federal government has [estimated](#) that the number of deaths from heat alone will increase 15 times in the greater Toronto area within the next 8 years to just under 300 people a year. The 5000 to 16000 annual smog related deaths in Canada will only increase with more heat. The list of existing and worsening problems goes on. [Environment Canada](#) and [Natural Resources Canada](#) both have excellent information on the existing and foreseeable detrimental effects of climate change in Canada.

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MYTH 5: A FEW DEGREES MORE WILL BE REALLY NICE - ESPECIALLY FOR PLANTS!

When Canadians hear the range of predicted temperatures they often react by saying, “A few degrees...that’s it?! I’d love for it to be a few more degrees on average!”

Most don’t realize that this is a global average (we’ve already mentioned that it will be more than that in Canada) and that small changes in the global average can bring about huge effects. The last ice-age, for example, was only about 5 degrees Celsius cooler than today. If that little cooling could result in such drastic effects, what could happen with a much more rapid shift in temperature is truly frightening.

It’s also tempting to think that an increase in CO₂ will help plants as they use CO₂ to grow and higher temperatures mean longer growing seasons. But as anyone who has ever grown a plant will tell you, along with any science student who knows the equation for photosynthesis, one needs more than temperature and CO₂ to successfully grow a plant. The other key ingredients are of course sunlight and water.

The water cycle will be drastically altered with increased temperatures, increasing the number and severity of both droughts and floods. Higher temperatures increase the rates of evaporation from the surface. When conditions momentarily shift, the massive amounts of water now held in the atmosphere flow down in torrential quantities. Unfortunately, the prairies are already seeing this new pattern emerge. What good is a longer growing season if it’s just longer drought?

It’s a dismal surprise for many to find out that sunlight will also be altered. Global warming will likely [increase ozone layer depletion](#) – bringing about more plant-damaging UV rays.

And we haven’t even mentioned the increase in infestations because insect larvae can now better survive through winters nor have we mentioned the increase in the frequency and severity of fires.

A relatively recent [article](#) in the journal *Science* is one of many that show that plants won’t even be able to adapt or ‘migrate’ north because climate change will be too fast (plants migrate in the sense that seeds can make their way to hospitable climates through such vectors as air currents and animal carriers).

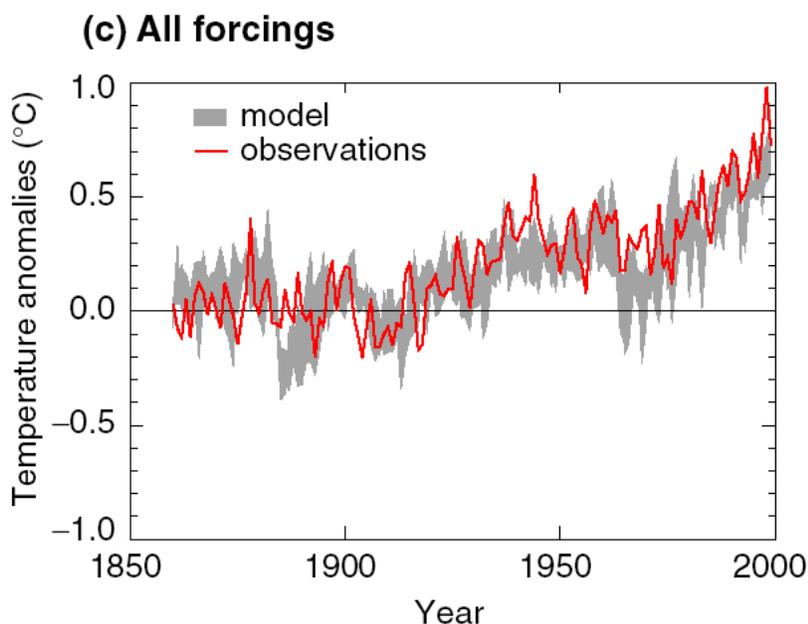
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MYTH 6: THE SCIENTIFIC MODELS AREN’T VERY GOOD AT PROJECTING THE FUTURE

Because it’s impossible to do traditional science on the entire atmosphere (you can’t, for example, manipulate one variable and see how all the others change and then jump in a time machine and re-run the experiment a few times) scientists are left with computer simulations that rely on using the well established scientific equations describing the atmosphere and oceans. Some would have us believe that we just don’t and even can’t ever fully understand the complexity of climate. Of course we won’t fully understand. Do you *fully* understand relationships before you do anything? Life in general? In life we have to work with what we do or can understand and make responsible decisions based on that understanding. As it turns out, our present understanding is more than adequate to act.

Sometimes it seems like people are expecting scientists to invent a functional crystal ball. Of course that's impossible, but it's amazing how close they've come nonetheless. The [models](#) are incredibly intricate and require super-computers in order to crunch through the data.

The main way that scientists test the validity of the models is to see how the models do at matching past temperature patterns. The following graph shows the match between observed data for the past 140 years and what the model would have arrived at. This model, acknowledged by the IPCC working group I, incorporates a wide range of factors including natural ones (volcanoes, solar radiation changes, etc.) and human induced (fuel burning, deforestation, etc.). **As you can see, it's far more 'on' than 'off' at trying to capture the pattern.**



Source: [IPCC](#), Working group I, Summary for Policy Makers (SPM), Third Assessment Report (TAR), page 11.

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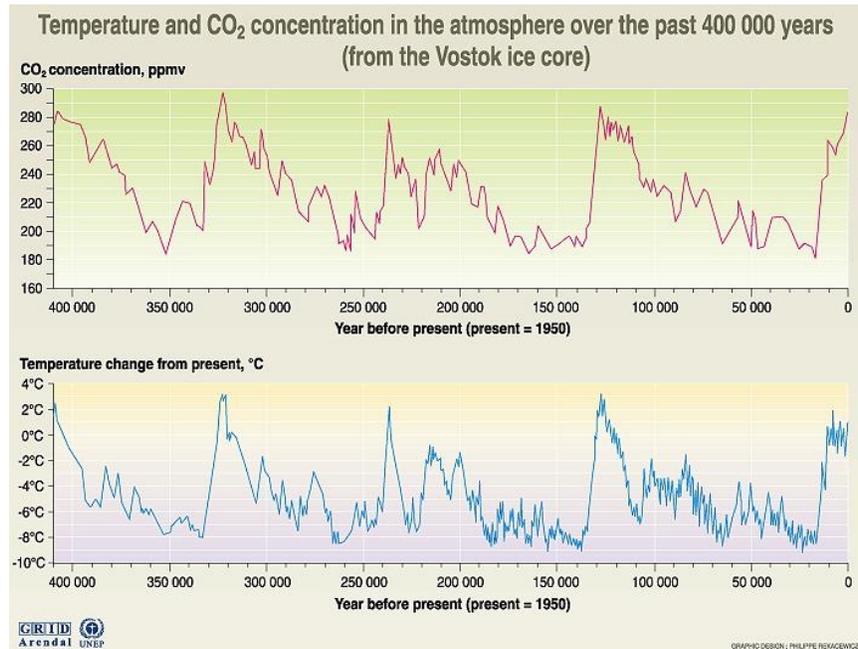
MYTH 7: CARBON DIOXIDE LEVELS ARE NOT STRONGLY RELATED TO TEMPERATURE – HOW COULD THEY IN SUCH TRACE AMOUNTS?

Some skeptic organizations like to play upon people's misunderstanding of what scientists are saying. They point to periods of time where CO₂ concentrations went up and temperature went down or remained unchanged and then tell you that this lays the CO₂ warming theory to rest.

The key idea here is that CO₂, like all greenhouse gases, has the *general* effect of heating up the atmosphere. *Of course* there should be times where temperature and gas concentrations don't move up or down in perfect synchrony because CO₂ is just one of many factors to influence the world's temperature. Overall however, the idea is that generally the more you put in the sky, the warmer it gets and this is well supported by evidence.

If you look at the following chart, originally published in the scientific journal *Nature*, you'll note two things. One is that CO₂ exists in very small or trace concentrations (ppmv = parts per million by volume). Remarkably, CO₂ influences temperature *despite* existing only in trace amounts.

The other thing you will notice is that “present” means 1950. **Since 1950, the levels of CO₂ in the atmosphere have gone up to about 370 ppmv** – completely off this chart which goes back 420 thousand years. That is, the upper line has since continued well up to the right.



Source: J.R. Peill, J. Jouzel, et al. Climate and atmospheric history of the past 420 000 years from the Vostok ice core in Antarctica, *Nature* 399 (3&4), pp 429-436, 1998.

Source: [GRID](#) (Global Resource Information Database of the United Nations Environment Program in Arendal, Norway)

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MYTH 8: SATELLITE MEASUREMENTS HAVE NOT SHOWN THE WARMING TRENDS.

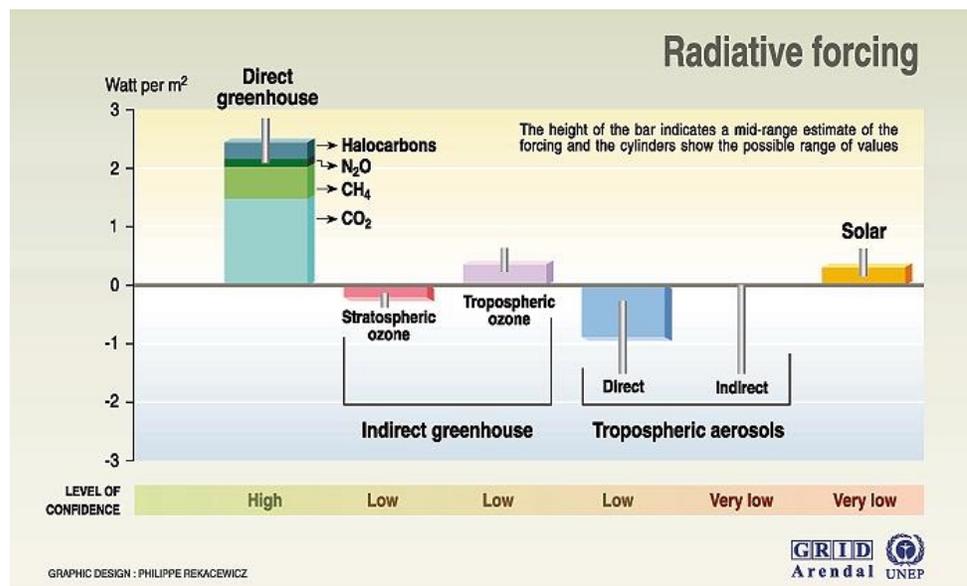
Again, from the Union of Concerned Scientists of the USA:

It is true that temperature records derived from satellites show either less warming than surface temperature data or even a cooling trend. Recent studies (most notably a study by the National Academy of Sciences published in 2000) found, however, that satellite data needed to be adjusted for some measurement and calibration problems. These adjustments bring surface and satellite records into better agreement, both showing a warming trend. It is important to note that many surface temperature records date back to 1860, while satellite records only date back to 1979. With such a short data record, observed trends can be strongly affected by extreme conditions -- such as the 1991 eruption of Mt. Pinatubo which decreased atmospheric temperatures for several years. In addition, satellite and surface data differ in what they record: surface thermometers measure the air temperature at the Earth's surface, while satellite data take temperatures of different slices of the atmosphere. Including records for the upper atmosphere -- where the depletion of the ozone layer has had a cooling effect -- will lower the overall temperature trends observed from satellites.

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MYTH 9: THE OBSERVED WARMING IS ALL DUE TO SOLAR RADIATION VARIABILITY, NOT HUMAN ACTIVITY

It is clear to those readers who have read the first 8 Myths that there are a number of factors that influence the temperature on the planet. And again, it would be hard to imagine that IPCC scientists would not have reviewed the literature about this possibility. In fact, they did so. According to IPCC findings, the warming effect due to increases of greenhouse gases in the atmosphere is estimated to be more than 8 times greater than the effect of solar irradiance changes.



Source: Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.

Source: [GRID](#)

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MYTH 10: SCIENTISTS/ENVIRONMENTALISTS ARE EXAGGERATING IN ORDER TO GET MORE FUNDING

The IPCC's findings have less bearing on funding decisions than some assume. Environment Canada has announced that it will no longer fund the [Eureka Arctic Stratospheric Ozone Observatory](#) which was a research station studying, amongst other things, the link between ozone depletion and climate change.

Speaking out can actually be detrimental for a scientist's career. The past chairman of the IPCC, Dr. Robert Watson of Harvard University, lost this position after holding it for several years. The [White House](#) and [Exxon](#) admit to lobbying for his removal.

If anything, the environmental community has been too cautious in expressing concerns. The anticipated changes documented in the IPCC reports are based on a doubling of atmospheric carbon. Unless we reduce carbon dioxide emissions by 70% very rapidly, we will not be able to avoid a doubling and will be looking at newer and scarier scenarios of a 3X or even 4X carbon world. No one is really looking at the Worst Case Scenario in which a run-away greenhouse effect destroys the ability of the atmosphere to support life as we know it.

This 'Myths' list was created for the Sierra Club of Canada's National Website:
<http://www.sierraclub.ca/national/climate/ten-myths.html>

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The Sierra Club of Canada's mission is to develop a diverse, well-trained grassroots network working to protect the integrity of our global ecosystems. The Sierra Club mission focuses on five overriding threats: loss of animal and plant species, deterioration of the planet's oceans and atmosphere, the ever-growing presence of toxic chemicals in all living things, destruction of our remaining wilderness, and spiraling population growth and over consumption.

In Canada, the Sierra Club functions locally, provincially, nationally and internationally. Through the Sierra Club of Canada's National Office in Ottawa, we run a number of major national campaigns:

- promoting energy efficiency to fight climate change
- protecting Canada's forests from unrestricted clear-cut logging
- conserving our biological diversity (the range of wildlife and plant species)
- exposing the risks of pesticides working for wilderness preservation from coast to coast to coast
- following up global commitments made in Rio at the Earth Summit
- exposing the economic causes of global environmental decline
- advocating the phase-out of nuclear power in Canada and challenging the federal government's sale of CANDU reactors abroad.

Through our British Columbia, Prairie, Eastern Canada and Atlantic Canada chapters, Sierra Club of Canada pursues issues from toxic clean-up of the Great Lakes and Sydney Tar Ponds in Nova Scotia to protecting the remaining ancient rain-forests of Vancouver Island and B.C.'s mainland coast.

Across the country, Club chapters and their local groups are pursuing a variety of campaigns. Volunteers are the backbone of our campaigns - organizing locally, raising awareness, and holding elected representatives responsible for their actions.