

Keeping our cool

A CLIMATE CHANGE PRIMER

national union



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September 2006

Everybody talks about the weather.

But nobody ever does anything about it.





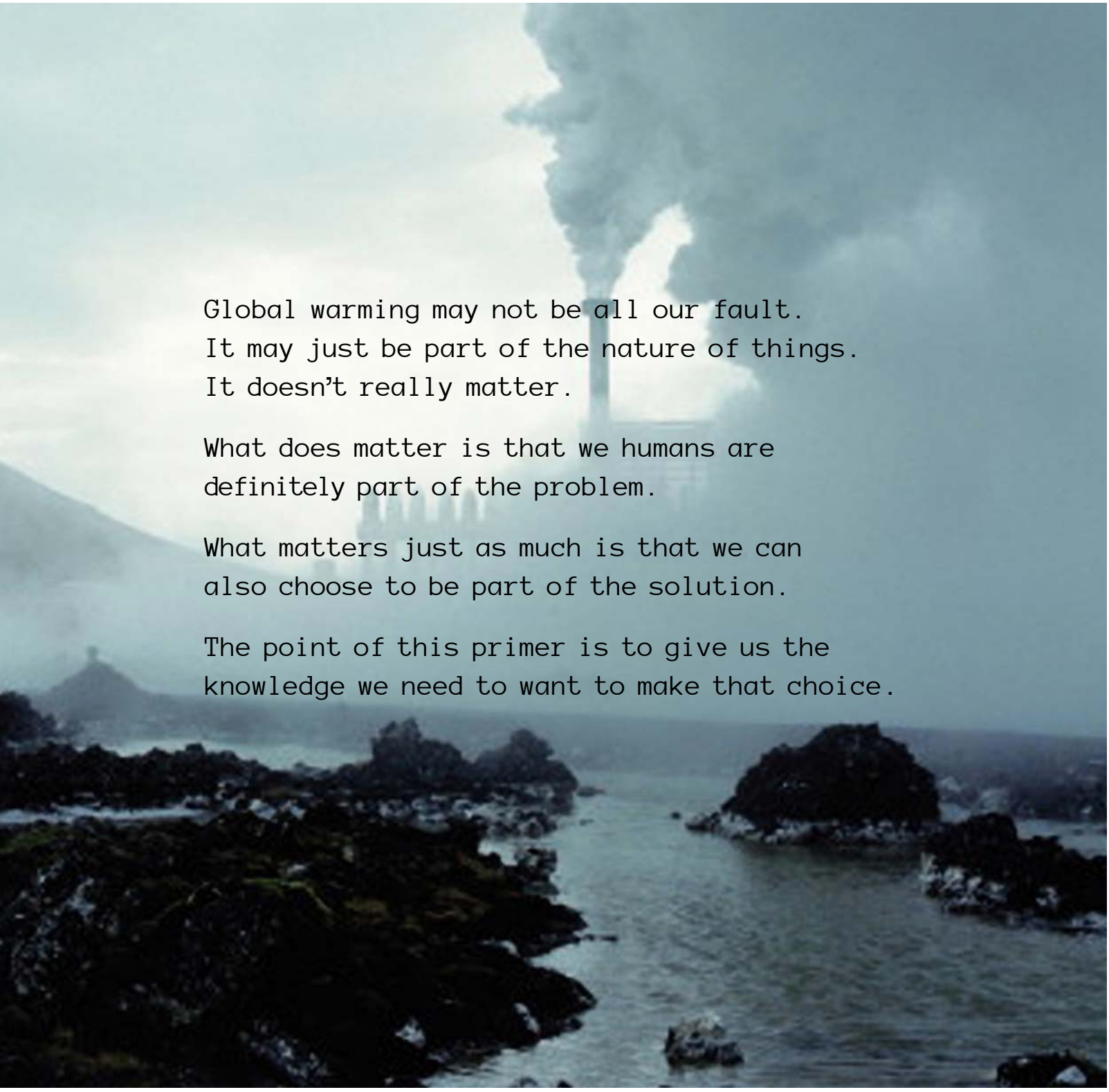
Hurricane Katrina moves in over Louisiana
August 2005

Make it better.

Make it worse.

It’s our choice.





Global warming may not be all our fault.
It may just be part of the nature of things.
It doesn't really matter.

What does matter is that we humans are
definitely part of the problem.

What matters just as much is that we can
also choose to be part of the solution.

The point of this primer is to give us the
knowledge we need to want to make that choice.

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Summary

WHAT'S WRONG WITH THE WEATHER? It's hard not to ask. The news is full of reports about extreme weather events (things that used to happen once in a lifetime) that now seem to happen everywhere, all the time.

And it's not just the weather. There are troubling reports of all kinds of other odd things: Arctic ice shrinking enough to soon allow ships to easily sail through the Northwest Passage; the Greenland ice cap shrinking fast; Antarctica melting; sea levels rising; animals moving far beyond their usual habitats; coral reefs dying.

The reality is that nothing is like it was, and may never, ever be like it was again. And it's all because of one thing, and one thing only: the rise in the temperature of the earth, global warming.

Good Hot / Bad Hot

But, not all global warming is bad. In fact, we wouldn't be here if it wasn't for the warming from the *natural greenhouse effect.*

The best science we have tells us that we must keep global warming to below 2° C.

The earth has a layered atmosphere that acts like greenhouse glass to trap solar radiation and warm the earth, while shielding the surface from life threatening UV rays. It's what makes the earth fit for humans and all living things.

Bad global warming is something else again. It heats things up too much. Life as we know it begins to change—and not always for the better.

Much of the rise in our global temperature—some say all of the rise—is due to what we humans have done. Since the Industrial Revolution, over 200 years ago, we have been spewing gases into the atmosphere primarily with the burning of fossil fuels, but also with the industrialization of agriculture.

As concentrations of these gases, like carbon dioxide, methane and nitrous oxide, accumulate in the atmosphere they affect our global climate. These gases are known as *greenhouse gases* (GHGs) because they add to the natural greenhouse effect, making our planet warmer.

Extreme weather and every single other effect of climate change are due to this temperature increase. The 2001 data from the United Nations' Intergovernmental Panel on Climate Change (IPCC) found global temperature to be 0.6°C higher than pre-industrial temperatures.

The Magic 2°C Limit

The best science we have tells us that we must keep that increase below 2°C. If we don't, the predictions are that we will face catastrophic events which we cannot even imagine and may not be able to survive.

What's in store for us if we can't keep our cool? We will see more melting of glaciers and ice caps. Fresh melt water added to the ocean surface will drastically affect currents and ocean circulation. The consequences could include everything from a European ice age, to the death of marine ecosystems all over the globe.

Species extinctions, coral reef bleaching and expansive forest fires are also predicted.

The sea level rise is estimated to be between 0.09 m - 0.88 m in the next century. This kind of increase will have fatal consequences

for human populations all over the world. Entire cities, with populations in the millions will be flooded. The human and financial costs will be almost beyond calculation. But in fact, insurance companies are at work preparing for these scenarios and trying to find ways to share the risk burden.

It is clear that one change can precipitate another, causing a cataclysmic chain of events. Much of the predicted effects are unknown in their severity and scope. In some cases, as in species extinction, there will be no turning back or any hope of repair and restoration.

If we don't do something fast the global average temperature in the next century is expected to increase by at least 1.5°C and perhaps by as much as 4.5°C—making a bad situation much, much worse.

Preparation for all that is to come is crucial; but acting to reduce the severity of what we face is even better. The best way to do that is to reduce global warming. And the best way to do that is to reduce our greenhouse gas emissions.

Right now our best chance of reaching our 2°C target is the Kyoto Protocol.

Counting on Kyoto

Right now our best chance of getting global warming under control is the Kyoto Protocol.

The Kyoto Protocol is an international treaty under the United Nations Framework Convention on Climate Change (UNFCCC). It has 156 countries as signatories and binds the industrialized nations of that group to reduce greenhouse gas emissions by five percent below their 1990 levels by 2012.

After 2012, a new phase for mitigation will hopefully pick up and lead to even deeper cuts in emissions. The David Suzuki Foundation and the Pembina Institute have proposed that Canada's long-term targets be a 25% reduction in our greenhouse gas emissions by 2020 and 80% below the 1990 levels by 2050.

Many estimate that 80% reductions below the 1990 level are needed to stabilize global temperature at 2°C above the pre-industrial temperatures.

Post 2012, developing nations will need to become involved in mitigation, assuming they have increased their greenhouse gas emissions in the industrialization process. Calculations show that

Soft energy paths utilize renewable energy sources like wind and solar.

without this combined effort between the North and South, the world will not be able to reach that 2°C stabilization of rising temperatures.

Currently, the Kyoto Protocol has a Clean Development Mechanism in place to provide an opportunity for developed countries to build a clean alternative energy infrastructure. This mechanism allows industrialized nations to meet their emissions reductions in the short-term by buying "carbon credits" from developing nations. The nations selling the credits must spend the money gained in clean development projects. The aim is to have developing nations on track towards zero emissions by 2012.

This kind of carbon trading has its own problems. However, many are urging nations to stick with the system as it is currently our best effort towards a just sharing of the atmosphere.

Non-governmental organizations in the Climate Action Network Canada have sketched out a variety of options that will enable Canada to meet its Kyoto commitments, plus put us on a path to achieve deeper reductions in the next 50 years. Two basic principles of the plan are a move to efficiency in all our energy usage, and a planned shift from fossil fuels to a *soft energy path*.

Softer is Better

Soft energy paths are those utilizing renewable energy sources, like wind, solar, micro-hydro, hydrogen fuel cells and biogas. The study *Kyoto and Beyond* describes detailed actions in five sectors to move us to a soft path energy society. The sectors are: buildings, transportation, product efficiency, industrial output and phasing out nuclear and coal electricity generation.

We will find that soft energy options, in the long-term, are more sustainable and will cost the least. The proposed changes anticipate a 50% per capita increase in Gross Domestic Product, making these shifts affordable.

The progress of Canadian industry in the wind, solar and hydrogen fuel cell sectors is exciting. Federal support must continue to see expansion and improvement so that these

industries can replace fossil fuel and nuclear energy paths in the next century.

There are opportunities for federal, provincial and municipal governments to tighten up industrial standards, efficiency codes and shift infrastructure to a soft energy path.

Efforts by the Canada Green Building Council accelerated their Leadership in Energy and Environmental Design certification activity for commercial and public buildings. In 2005 federal funds helped promote this certification for institutional buildings.

Energy Star and R-2000 codes should be implemented. They are money saving and produce the emissions reductions required to meet our targets.

Some industries are leading the way with improvements in efficiency that provide them with significant savings, but these changes need to be made in every industry to meet our Kyoto target reductions. Standards for cars and truck fleets can be improved with the technology that exists today.

The way to a cooler world is clear and the technology to achieve it exists. There is little doubt about whether we can meet our international commitments and become world leaders in building sustainable communities.

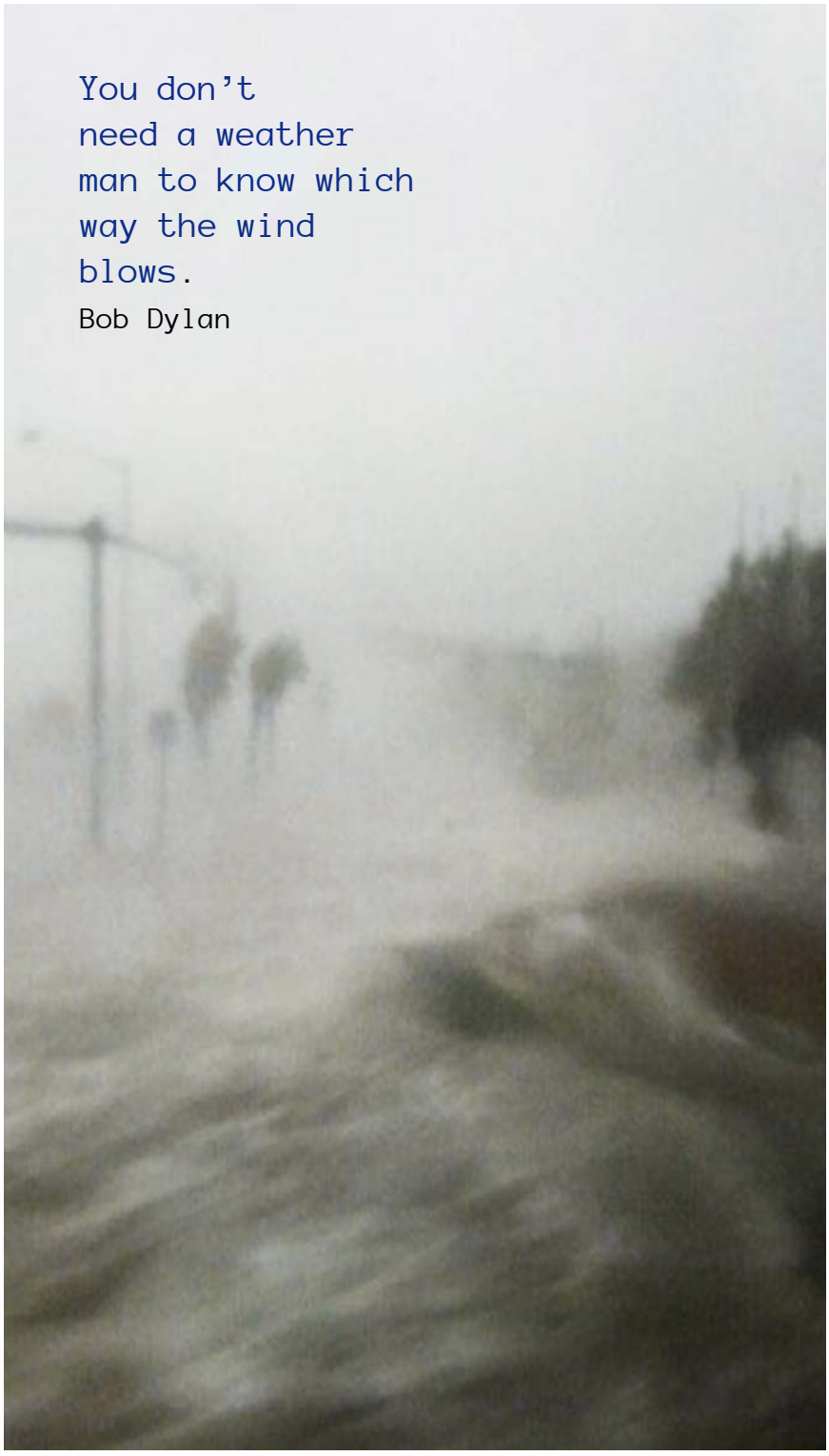
What is in doubt is whether we will do enough, soon enough. What is in doubt is whether we have the leadership it will take to create and sustain a national understanding of the need to combat global warming and the willing desire to do it.

The problem (threat) of global warming is real. So are the solutions. Knowledge about what is happening and why it is happening is no longer what we need most.

What we need most now—what we need most to keep our cool—is to choose to do something to reduce global warming. Something immediate and direct.

What we need most is to choose to pursue a future bright with the promise of an earth fit for human beings and all other living things.

What we need most now is to choose to do something about global warming. Something immediate and direct.


You don’t
need a weather
man to know which
way the wind
blows.
Bob Dylan

CHAPTER 1

Reality Check

NOTHING IS LIKE IT WAS OR WILL BE

SOMETHING STRANGE is going on and we all know it. We see it on TV, we read it in the headlines—we feel it in our bones.

There's the weather for a start: too much severe weather, too often. And then there's all the rest: reports of melting ice caps, rising sea levels, expanding deserts, animals showing up when they never did before and where they never did before. Life on earth is changing right before our eyes, right under our feet.

Just how much it's changing and how fast can be surprising—and even a little frightening.

Canadian Severe Weather Events

We used to call them once-in-a-lifetime events. Now severe weather events are becoming as regular in Canada as the changing of the seasons. A list of some of the worst in recent years includes:

- 1998 Ice storm in eastern Ontario and west Quebec: hundreds of hydro towers collapse causing days of power outages
- 1999 Flood in and around Saguenay, Quebec: our first billion dollar disaster
- 2000 Tornado in Pine Lake Alberta: 11 are left dead
- 2003 Raging prairie fires in Alberta
- 2003-2004 Three "50-year storms" in less than 12 months hit Nova Scotia. The two worst are the full-blown Hurricane Juan



Quebec



British Columbia



Eastern Ontario



Nova Scotia



Alberta



Alberta



Ontario



Southern Ontario

and, four months later, "White Juan," a blizzard
- 2004 British Columbia endures a year of wind storms, deadly avalanches, summer forest fires, fall floods and an early winter with record rains
- 2004 Flash flood in Peterbough, Ontario: 14 billion litres of water fall in just five hours. It is called a "once-in-200-years" event
- 2005 Severe thunderstorms in Southern Ontario: damage exceeds $500 million

David Phillips, Environment Canada's Senior Climatologist, sums up the Canadian weather catastrophes of the last decade this way:

> *When we look back over the last 100 years, we expect the weather to be more or less what it has always been. But now, because our climate is changing so quickly, the past 10 years may serve as a better guide. This past decade provides ample warning that Canadians, rather than being immune to the ravages of weather, are instead becoming increasingly more vulnerable. Today's weather extremes may be tomorrow's norm.*[1]

Today's weather extremes may be tomorrow's norm.

David Phillips
Climatologist

Northern Hemisphere Changes

An IPCC survey of 20th century research found that:
- North American lakes and rivers have lost two weeks of ice cover.
- Our growing season has lengthened by about one to four days per decade during the last 40 years—a dubious advantage. In one region this lengthening of the seasons may come with increased storms, eroding soil. In another region it may come with drought conditions. One factor can never be taken in isolation when predicting climate changes.
- Habitat ranges for plants, insects, birds and fish are shifting pole-ward.
- Increasing temperatures caused earlier plant flowering, earlier bird arrival, earlier dates of breeding season and earlier emergence of insects in the Northern Hemisphere.

It is likely that entire ways of life, whole cultures, will be lost with these changes.

The Arctic

In 2000, a four year long study involving indigenous people and 300+ scientists began. The resulting 2004 Arctic Climate Impact Assessment (ACIA) reported that the Arctic climate is warming rapidly.

Communities are seeing increased storms as bodies of water once covered with ice become exposed. These new open water channels may increase marine transportation, adding secondary risks such as oil spills and pollution from freighters.

Permafrost melting is affecting building foundations and other infrastructure. In addition, rapid weather changes are making land transportation more difficult and unpredictable. This makes hunting excursions dangerous, destroying what is a key survival and cultural pastime.

Ecosystems in the Arctic will be impacted significantly as increased UV radiation reaches the polar regions. Vegetation zones are very likely to shift with the increased warming. Useable habitat for bears, seals, sea lions and other mammals is disappearing with the melting ice shelf.

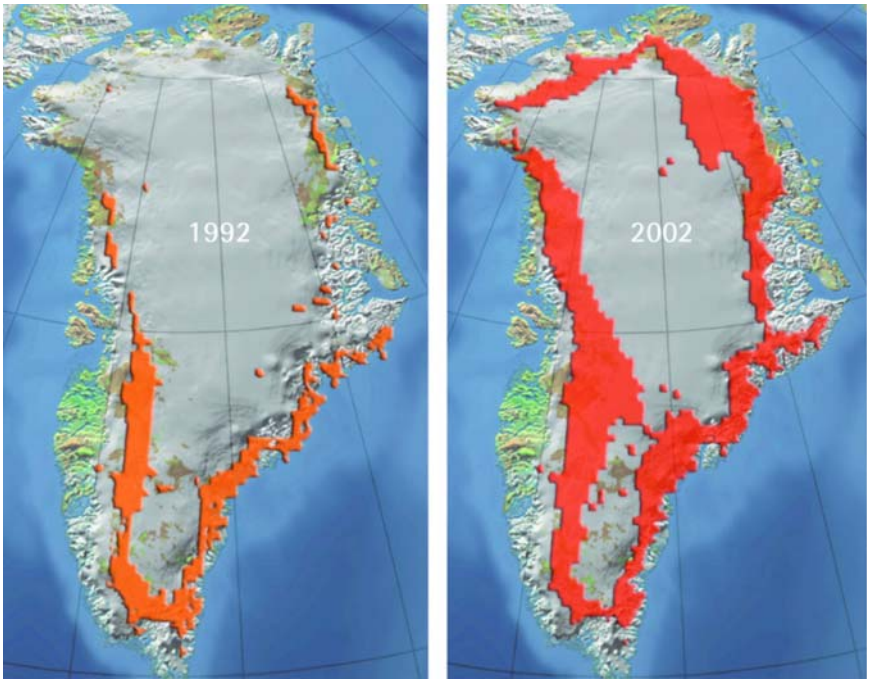
It is likely that entire ways of life — whole cultures — will be lost with these changes. Indigenous communities will be facing economic and cultural impacts that quite possibly can't even be predicted at the present time.[2]

In 2001 the IPCC report established that the Arctic sea-ice extent and thickness is diminishing at an increased rate from half a century ago, decreasing at around 40% in the summer and fall of recent decades.

Greenland's Ice Cap

The north polar ice cap is shrinking. The significance is twofold; it both demonstrates how comparatively warm the seasons are getting, and the melting creates a positive feedback system to accelerate warming. Because the dark water is now exposed, the albedo at the poles has changed. Now the oceans at the poles absorb more heat and further increase the ice cap melting.

Time Magazine reported, "...in 1996 Greenland dumped 90 times as much water into the sea as Los Angeles consumed; last year it



Map 1

NASA composite image of Jakobshavn Isbrae glacier in Greenland. The warmer temperatures increase the amount of melt water reaching the glacier-rock interface where it serves as a lubricant that eases glaciers' march to the ocean.

was up to 225 times." The speed of this massive melt was unexpected and not predicted by any computer model.[3] There are two theories that explain the rapid outflow of the Greenland glaciers:

1. The fracturing and melting of the ice "tongues" or shelves that line Greenland's shores were acting to brace the free flow of inland glaciers; and

2. The effect of melt water trickling down through cracks and crevices to promote the sliding of the ice mass.

Greater loss of ice masses are expected in the future. This will influence the input of fresh water into the North Atlantic.

The ocean conveyor belt that moves warm water towards Northern Europe (the Gulf Stream) depends on cold, saline water sinking to drive the conveyor back down to the tropics to reheat the ocean water. The addition of fresh water to the ocean surface will affect the inertia of the conveyor belt. Stalling the flow of this system will have significant effects on global and regional climates.

The IPCC identified that non-polar glaciers around the globe had experienced widespread retreat during the 20th century.

The Antarctic

In 2004 the Natural Environment Research Council British Antarctic Survey reported that Antarctic temperatures and ice cover were relatively stable for the bulk of the continent. However, the Antarctic Peninsula was more vulnerable and showed signs of increased melting. Because the bulk of this ice is floating on the ocean, no increase in sea level with its melting was expected, although fresh water would be added to the ocean's surface.

A second report by the same body, published in *Science* (April 22, 2005) reported that melting is more rapid than they thought on the Antarctic Peninsula.



Map 2

Between January 31, 2002 and March 5, 2002 a chunk of ice the size of Rhode Island disintgrated from the Larsen B ice Shelf in Antartica

"These glacier retreat patterns combined with dramatic ice shelf break-ups leave us in no doubt that the Antarctic Peninsula ice sheet is extremely sensitive to recent warming," said British glaciologist David Vaugan.

As inland ice melts, it will add unprecedented fresh water to the surrounding seas. An increase in sea level will occur in this scenario, because inland ice displaces volume as opposed to ice floating on the ocean's surface. Temperature increases for the Antarctic Peninsula are currently five times the global average.

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Sea Levels

The IPCC 2001 report states that in the 20th century, the global mean sea level increased at an average annual rate of 1 to 2 mm. With the addition of recent glacial and ice cap melting we could see that rate increase.

In Canada we need to consider rebounding effects from the recession of the last glacial period. Rebounding refers to the upward movement of the earth's crust when large masses are removed. In the case of the last glacial period, a mile of ice gradually retreated North from the bulk of Canada's land mass and a slow rebound of the land followed and continues in some locations today. In Canada's West, some parts of the coastline are still rising showing a net decrease in sea level as a result of rebounding. Other geological effects are influencing sea level rise, as in Nova Scotia: "Unfortunately, in Atlantic Canada (except Labrador) sea level has been rising for thousands of years, mainly because the earth's crust in this area is sinking. The predicted increase will be ADDED to the increase already happening."[4]

Projects are being initiated regionally around the globe to monitor sea level increases and coastal erosion. With projected sea level increases for PEI of between 30 and 110 cm by the year 2100, plans need to be laid to control coastal flooding.

British Columbia's Ministry for the Environment reports that tide gauge data—which show relative sea level—suggest that global average sea level rose between 10 and 20 centimetres during the 20th century. This rate is about 10 times faster than the rate over the previous 3,000 years.

At the Fraser River delta, Richmond planners are taking scientific findings on climate change seriously. They are preparing for quakes, which cause wave surges and sea level increases due to polar melting.[5]

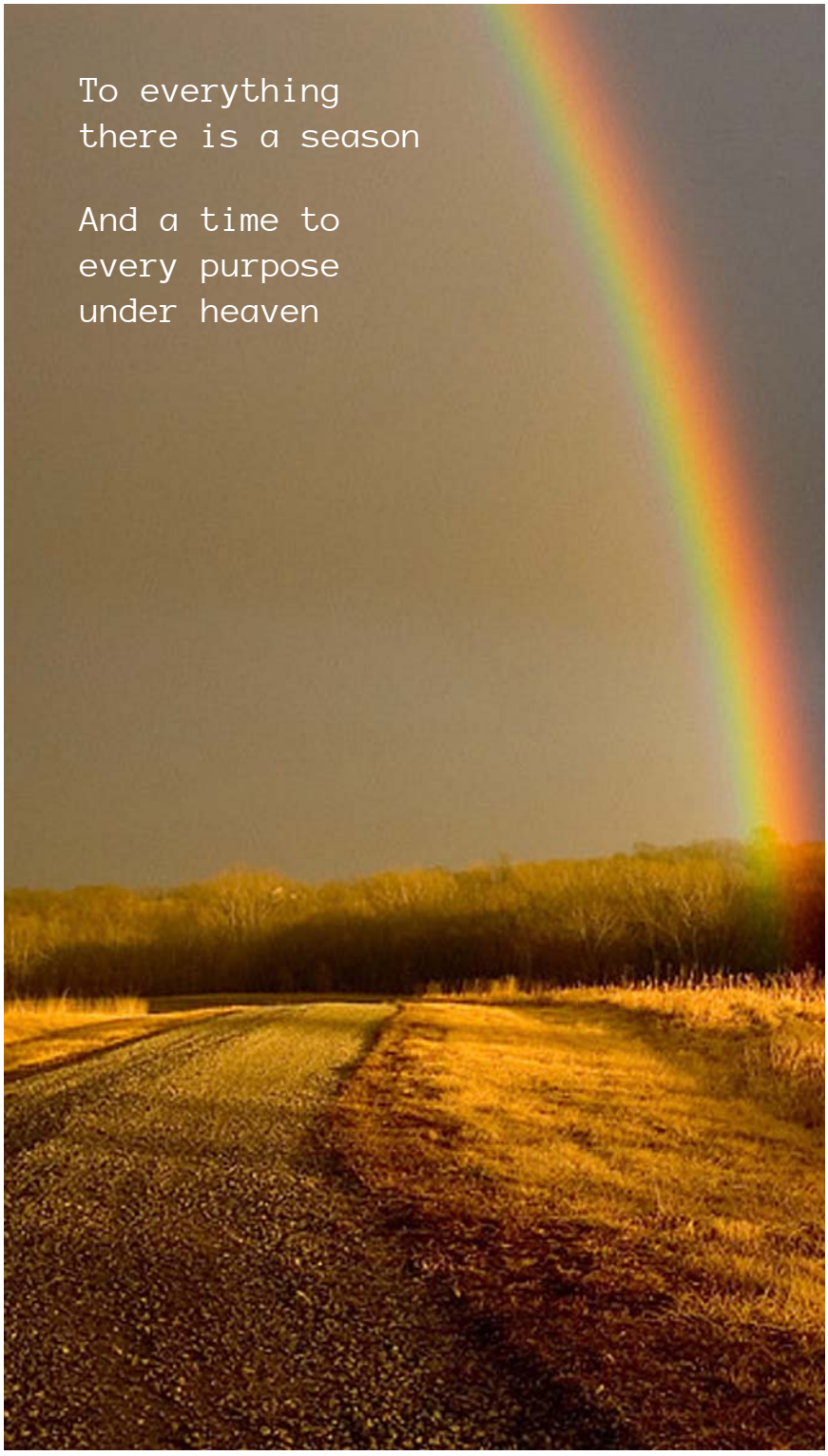
Tropical Impacts

Coral reefs are already under much stress from fisheries, coastal development, erosion and pollution. When a reef is "bleached", it whitens due to the death or alteration of small organisms (zooxanthellae) that live symbiotically within the coral host. Bleaching also occurs from natural causes (like disease or natural variation in the reef environment) and is also influenced by fresh water influx, decreased sea levels, increased sea temperature, pollution and sedimentation from coastal erosion.[6]

Researchers have observed that bleaching events have been increasing in both frequency and extent worldwide in the past 20 years. There is reason to believe that global climate change may play a role in this increase. It is also likely that these effects will ultimately lead to the extinction of some coral species.

Blame global warming

The 2001 report of the Intergovernmental Panel on Climate Change (IPCC) lists all these effects and events as the result of the increase in global warming.


To everything
there is a season
And a time to
every purpose
under heaven

CHAPTER 2

Good Global Warming

WARM ENOUGH TO GET LIFE STARTED

WE WOULDN'T BE HERE if it wasn't for the climate. Life on earth—all life—depends on our climate.

When we think of "climate," we take it to mean the weather around us, the changing seasons, storms, heat waves, cold snaps, perhaps even smog.

Global climate is an average of regional climates around the world. When we talk about "climate change" we mean the changes in the earth's temperature on average.

It takes a long time for climates to change. The factors affecting these long-term changes are:

- the amount of *solar radiation* (the sun's energy);
- the chemistry of our *atmosphere*;
- clouds; and
- the living layer of the earth (the *biosphere)*.

Solar Radiation and the Greenhouse Effect

When the sun's rays hit the earth's atmosphere, the ozone layer filters and reflects some of the UV rays. The rays that make it to the earth's surface heat up the water and land.

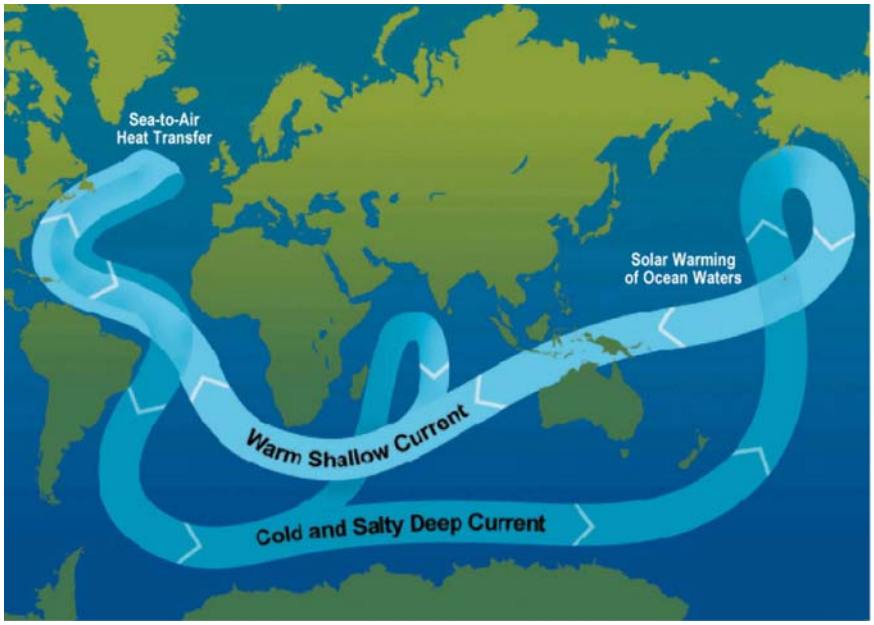
The warmed oceans and land re-radiate this warmth back up into the atmosphere where some of it is trapped, creating an envelope of warmth surrounding the earth.

We call this phenomenon, the *Greenhouse Effect.* It is why life on earth is able to flourish.

The Biosphere

The biosphere includes all plant and animal life on earth. There is a huge variety of environments in the biosphere—all reflecting more or less light. The differences in reflective capacity are measured as *albedo*; the higher the albedo of a surface the more reflective it is. The albedo of the earth's surface is a key factor in determining global climate.

When the sun warms the oceans it has more direct impact at the equator and less towards the poles. This differential heating creates currents as heated water rises and cold water sinks. Fresh water at river mouths and near melting glaciers and icebergs also creates changes in water flow. These factors create an ocean circulation known as the *ocean conveyor belt*.



Map 3

The ocean conveyor belt system. Changes in the temperature and salinity of the ocean may cause shifts in this pattern, creating significant changes in global climate.

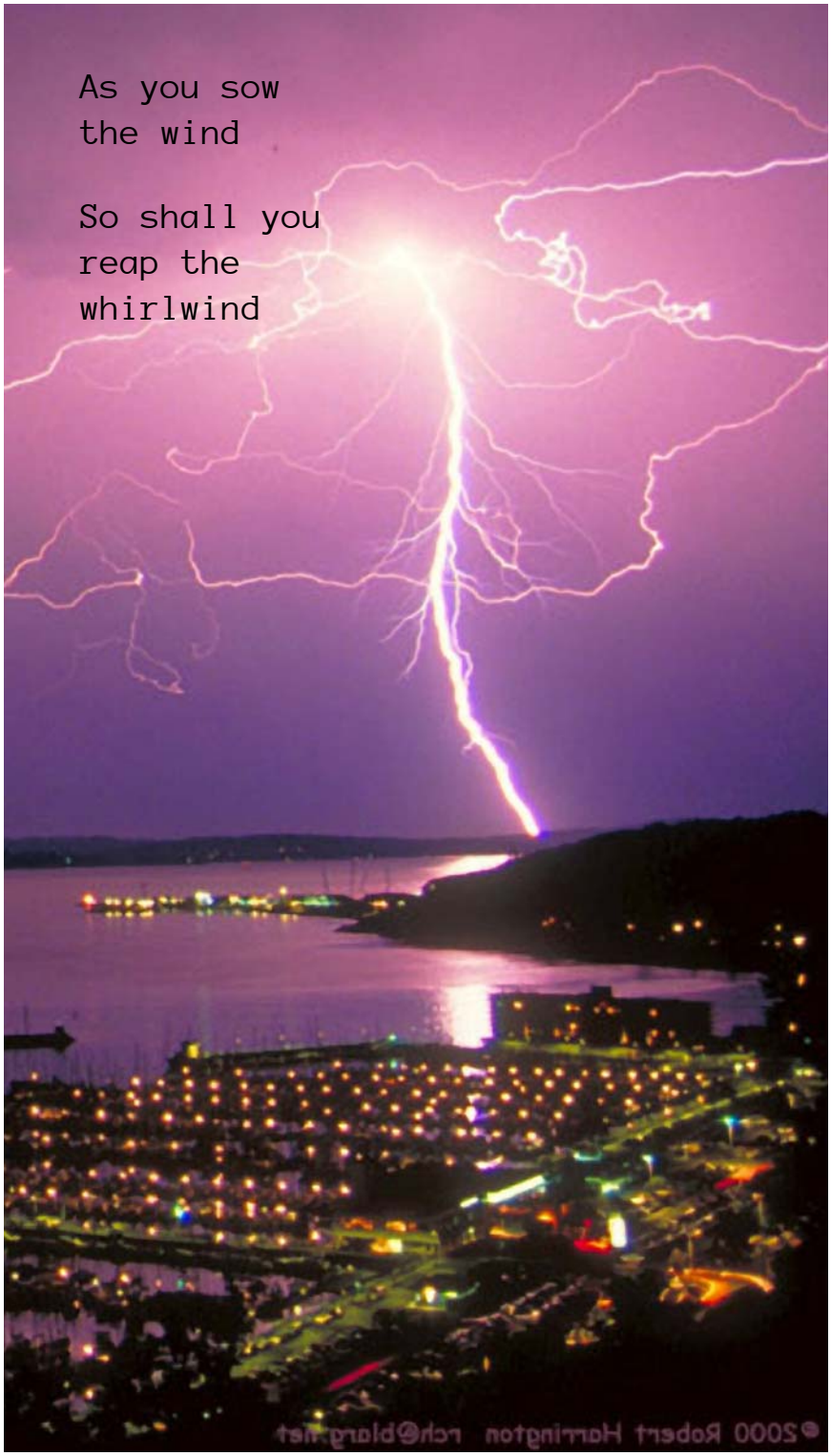
Within the ocean conveyor belt, there are currents which have a particular effect on climate. The *Gulf Stream* has a very profound impact on Atlantic fisheries, bringing warm water to the North Atlantic. As part of the same system, the *North Atlantic Deep Water* current gives Northern Europe its pleasant winter climates. The great masses of water on the earth's surface have a significant effect on global climate.

Our Atmosphere

Over our heads, the atmosphere has four distinct layers: the troposphere, the stratosphere, the mesosphere and the thermosphere.

The troposphere is the lowest layer where most of the weather occurs; clouds and moisture circulate in the troposphere. The stratosphere and the mesosphere are where the ozone layer scatters and absorbs UV radiation. The thermosphere is the thickest and highest layer. It is where the raw heat of the sun can be felt most.

These layers are composed of 21% oxygen (O_2), 78% nitrogen (N_2), with the remaining 1% being a mix of CO_2, O (ozone), and H_2O. Significant modifications to these proportions will have an impact on the earth's climate.


As you sow
the wind
So shall you
reap the
whirlwind

CHAPTER 3

Bad Global Warming

TOO HOT FOR OUR OWN GOOD

POURING ON THE COAL in the late 1700s is what started it all. We burned coal to fire all the boilers in all the steam engines that powered the Industrial Revolution. The heat was on and we've never really turned it off.

Our ingenuity spawned bigger, more powerful machines and we developed the capacity to harness energy from dams, petroleum products and finally nuclear fission. This technology has become more accessible and inevitably its impact has become greater and more pervasive across the globe.

According to the Intergovernmental Panel on Climate Change (IPCC), three factors are working together to accelerate change in global climate beyond natural global cycles: the release of greenhouse gases(GHGs), regional changes in the earth's albedo and an accelerated greenhouse effect. The release of greenhouse gases is now known to be the key cause of the increasing temperature of the earth.

Greenhouse Gases (GHGs)

1) Carbon Dioxide (CO_2) is released through the respiration of plants and animals—but with the burning of fossil fuels (coal, gas and petroleum), levels of CO_2 have risen. An increase of 31% in CO_2 since the beginning of the Industrial Revolution has caused

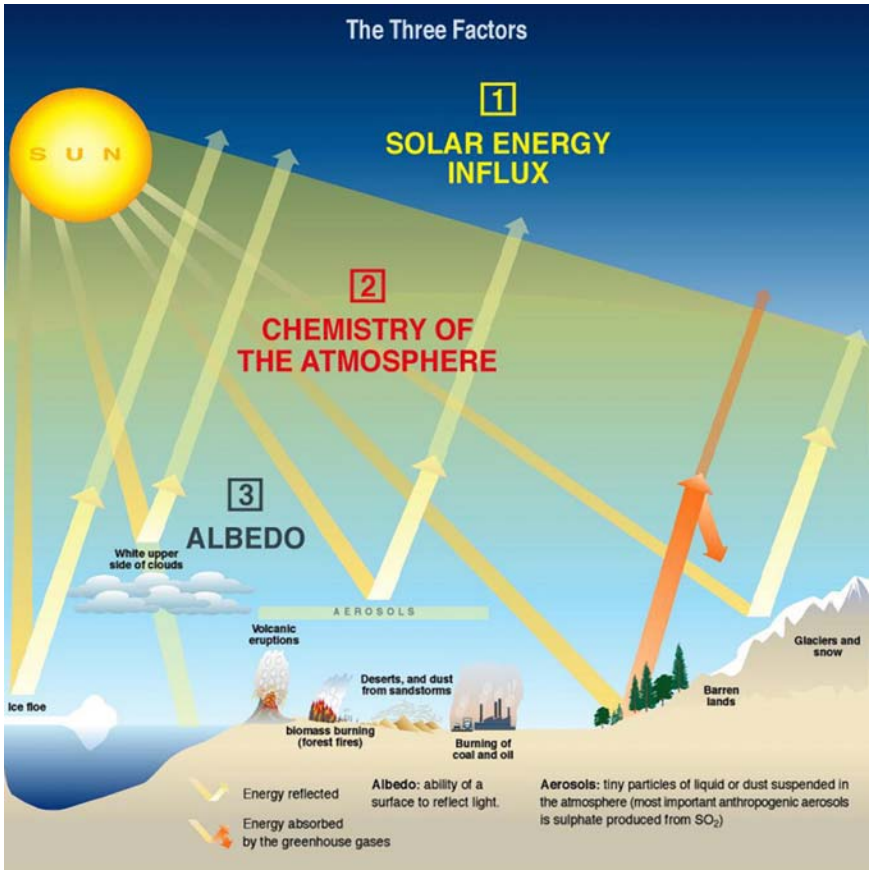


Figure 1

the atmosphere to retain more heat, enhancing the natural greenhouse effect.

Another significant source of CO_2 is deforestation. Forests are being burned all across the globe, doing double damage: first, by releasing huge amounts of $CO_{2;}$ second, by destroying trees and their much needed CO_2 storage capacity. This all-important storage capacity is referred to as a *carbon sink*. Carbon sinks help remove CO_2 from the atmosphere and "lock it up", taking it out of the atmosphere and the carbon cycle for long periods of time.

2) Methane (CH_4) is not as abundant in the atmosphere as CO_2, but has increased 151% since the Industrial Revolution began. It is now at its highest level in half a million years. NASA researchers have found that CH_4 emissions are much more potent as a GHG than previously thought. It has been estimated that methane warms the atmosphere 61% more effectively than CO_2.[1] Sources

of CH_4 include: fossil fuel production, landfills, biomass (like forests and waste) burning, rice paddies, and animal husbandry.[2]

3) Nitrous Oxide (N_2O) is predominately released by chemical fertilizers, and manure in agricultural systems and by fossil fuel burning. It has between 296 and 310 times more global warming potential than CO_2.

4) Halocarbons are human-made chemical compounds containing carbon and either chlorine, fluorine, bromine or iodine. They deplete ozone and are powerful greenhouse gases. Because they play a part in decreasing our ozone layer, they affect the atmosphere's natural UV scattering capacity for incoming solar radiation. The 2005 report by the IPCC indicates that there is now a stabilization of halocarbons in the earth's stratosphere. This is the result of international regulations adopted as the Montreal Protocol and reported on by the IPCC in 2005.[3]

5) Sulphur Dioxide (SO_2) is a byproduct of refining and burning petrochemicals and is an industrial air pollutant. It is one of the main contributors to acid rain and is harmful to human health. Due to improved efficiency of fossil fuel burning and pollution control measures, SO_2 is now decreasing in our atmosphere.

Our Changing Atmosphere

The first and most prominent change to our atmosphere is the increase in the average temperature of the earth. Throughout the 20th century, the IPCC calculates that the average increase has been 0.6°C. The 1980s set a record as the warmest decade in the last 1,000 years, but the 1990s were warmer still and now 2005 tops the charts as the warmest recorded year. Clearly this trend is accelerating.

Research on the temperature increase over the past 1,000 years using data from ice cores, corals and tree rings from the northern hemisphere shows the most unusual fluctuations from the mid-20th century to the present.

David Phillips, Senior Climatologist for Environment Canada notes: "Six of our warmest ten years in half a century have occurred since 1998. And, it was consistently warm, with 34 of the past 37 seasons being warmer than usual."[4]

Six of our warmest ten years in a half century have occurred since 1998 and 34 of our past 37 seasons have been warmer than usual.



KATRINA: THE STORM WE'VE ALWAYS FEARED

The Times-Picayune

'HELP US, PLEASE'

AFTER THE DISASTER, CHAOS AND LAWLESSNESS RULE THE STREETS

Local leaders call relief efforts too little, too late

Blanco demands thousands of troops

CHAPTER 4

How Bad Can It Get?

IT CAN'T BE GOOD WHEN INSURANCE COMPANIES GET NERVOUS

To date, there has been no significant decrease in the human output of greenhouse gases (GHG). So, we move along, conducting "business as usual" while some deny the problem and some stall over solutions. In spite of this, the predictions flow, with each article, each scientific paper and each belch of SUV exhaust.

Because climate is a complex web of contributing factors with multiple positive and negative feedbacks there is lots of room for error when creating computer models to predict changes. Estimations of the future situation could be blunted (that is to say not as severe as predictions); on the other hand they could be worse.

Temperatures

All of the predictions hinge on rising global temperatures. The greenhouse effect is what moderates the earth's temperature, keeping it relatively stable for life to flourish. But the dramatic increase in concentrations of greenhouse gases (GHGs); CO_2, methane, NO_2 and fluorocarbons, have initiated *radiative forcing*, which describes the augmented greenhouse effect. This radiative forcing will continue as GHG concentrations in the atmosphere rise.

Pre-industrial levels of CO_2 were 224 ppm; today they are 370 ppm and in 50 to 100 years they could easily reach 550 ppm (doubling since the mid-1700s). This rise in concentrations assumes


KATRINA: THE STORM WE'VE ALWAYS FEARED

The Times-Picayune

DISEASE, FIRE THREATEN CITY

Toxic floodwaters latest danger; remaining residents told to leave

St. Bernard, N.O. schools to close for rest of year

Nagin says water receding

we don't change current emission levels. A doubling of CO_2 could lead to an increase in temperatures anywhere between 1.5°C and 4.5°C, where 2.5°C is the best estimate.

Melting the Northern Pole

The IPCC is clear that further melting should be expected, as the north polar temperature increases disproportionately. The summer melting is estimated to total >50% reduction of the ice cap.

The Arctic Climate Impact Assessment (2004), commissioned by eight Arctic governments, including Canada's, examined the impact of losing anywhere from 50-100% of the summer ice cover by the end of the century. The cultural survival of these communities is virtually impossible with such dramatic changes in a relatively short timeframe. Many species will be threatened with extinction. Losing a strand in the delicate Arctic food web could be catastrophic for plant and animal species.

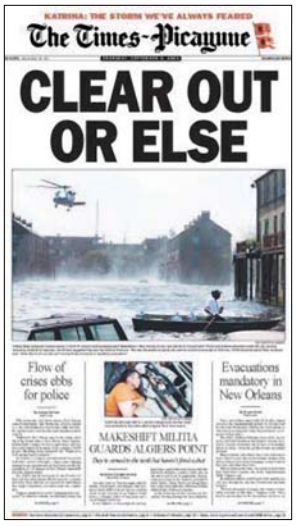
A secondary effect from increased melting is a decrease in albedo at the poles. Dark, open water will absorb more solar radiation than a highly reflective ice cap. As the ice cap melts, the poles get warmer, melting more ice. This positive feedback accelerates melting and temperature increases. Furthermore, increased temperatures will lead to melting of the permafrost, which will release methane. That, in turn adds to radiative forcing; a second positive feedback loop.

Archeologists are finding evidence suggesting that the climate change 11,000 years ago, during the Pleistocene to Holocene transition, occurred quickly. The glaciers covering most of Canada in the Pleistocene Epoch receded to create an ice free North America within 40 years. These rapid changes are thought to have contributed to the extinction of large mammals that were less able to adapt.[1,2,3]

Rising Sea Level

The rapid melting of the earth's ice caps and glaciers will lead to a sea level rise of 0.09 to 0.88 metres in the next 100 years.

In 2005 when scientists noticed the rapid breaking away of part of the Greenland ice sheet plus a portion of the western Antarctic


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peninsula, they realized that their models for predicting the rate of glacial melt and flow had failed. Climate scientists must now turn to observations of current climate events, climate modeling and paleoclimate assessment to predict sea level increases. The Natural Resources Canada website highlights the fact that if the Greenland ice sheet were to melt completely, sea levels would rise by six to seven metres. Climate scientists have developed models that estimate an increase of one metre in the next 100 years (about 10mm/year) (Overpeck et al, 2006; Oppenheimer 1998).[4]

Even the low estimations of sea level increases will cause havoc and much human suffering. "A rise in sea level of just half a metre... would flood an area of Bangladesh currently inhabited by eight million people", as reported by the American Association for the Advancement of Science.[5] Dealing with environmental refugees on this scale will require financial aid and infrastructure never before considered. Sea level increases will inundate dozens of Small Island States around the globe. These states have formed an alliance to encourage global cooperation to reduce emissions and save their countries.[6]

In addition, positive feedback effects are expected as sea level rises. Fresh water added due to glacial melt is more buoyant and doesn't sink. It absorbs some CO_2 from the atmosphere, but because it doesn't circulate into the deeper ocean, it soon becomes saturated with CO_2 and the absorption process stops. This reduces the ocean's capacity to remove CO_2 from the atmosphere, losing a valuable carbon sink that helps to regulate the greenhouse effect.

Ocean warmth promotes the release of methane, increasing GHGs in the atmosphere and increases evaporation in general. Water vapour's role in the greenhouse effect has recently been incorporated into climate change models. These loops are predictable but the rate at which they will influence change is unpredictable.

The effect of these sea level rises are broad and in some cases unpredictable:

- forest flooding, releasing more dangerous methane
- species threatened; polar bears to the coral reefs

- starvation as rice production is impacted
- flooding of cities and agricultural land
- spread of disease.

Intense Rainfall and Tropical Storms

More intense rainfall events and tropical storms may come out of sea level increases and the increase in global temperatures. This will be mostly regional and likely persistent in some areas. One thing the IPCC is sure of, is that regional climates will be worse for more people than better.

Every year there are more people living in coastal cities and, with declining infrastructure, many of those cities will suffer costly damage and loss of life. When Hurricane Katrina hit New Orleans, it was the failing of levies after the storm surge that caused millions of dollars of damage.[7] Coastal flooding during intense storms has already begun and unfortunately will be a familiar effect of climate change.

Water Shortage

The impact on the availability and distribution of water will depend on a variety of factors. Currently, fresh water supplies are under threats from corporate control and the draining of aquifers. A predicted doubling of the planet's population in the next century will add further pressure to waste water treatment as well as fresh water access.

Environment Canada predicts variations in regional effects. With regional predictions there is a higher degree of inaccuracy, making global models preferred. Environment Canada warns of droughts changing to desert conditions in the southern prairies, and flooding rivers in B.C. leading to increased erosion and mud slides. Forested areas and agricultural crops could move northward depending on suitable soil conditions.

A switch in land use will conflict with Native land rights and land claim processes and compete with forestry and exploration industries. Pest movement could eliminate any advantage for agriculture. The St. Lawrence River outflow could be reduced by 20%,

due to increased evaporation in the Great Lakes and decreased precipitation, which will have a dramatic effect on ground and surface water.[8]

Environment Canada warns of droughts changing to desert conditions in the southern prairies, flooding rivers in B.C. leading to increased erosion and mud slides.

Human Health and Famine

With the increase in heat waves, more deaths are expected. The World Health Organization (WHO) published a study showing an increase in malaria, malnutrition and diarrhea to be direct results of global warming.[9]

Deadly diseases often associated with hot weather, like the West Nile virus, Cholera and Lyme disease, are spreading rapidly throughout North America and Europe because increased temperatures in these areas allow disease carriers like mosquitoes, ticks, and mice to thrive.[10]

As far back as 1992, Oxford University reported that there would be a reduction in grain yields between 10-15%, in Africa, tropical Latin America and much of Southeast Asia and India.[11]

The Costs

Insurance companies are not missing out on the predictions. Munich Re Group and Lloyd's have prepared detailed documents summarizing the climate change science and are calling for new strategies in sustainable underwriting. Pressure from insurance companies and rising premiums could move industry towards emissions controls and carbon offset programs. "Failure to take climate change into account will put companies at risk from future legal actions from their own shareholders, their investors and clients," says Lloyd's of London.[12]

The Suzuki Foundation and the Pembina Institute, 2005, reported that,

> "Munich re-evaluated the cost of impacts resulting from a rise in the atmospheric concentration of CO_2 to twice the pre-industrial level by 2050. The total cost was estimated to be $US 300 billion annually in-

> cluding, for example, $US 47 billion of additional annual costs for the world's water management industry by 2050, and $US 42 billion of additional annual costs for agriculture and forestry."[13]

Environment Canada has been reflecting on industrial impacts. They reflected on the 1964 low water levels in the St. Lawrence causing a $35 million dollar loss to Great Lakes shipping and hydro power industries. In 1988 drought on the prairies caused a $4 billion loss in exports.[14]

Coral Reefs and Marine Ecosystems

By mid-century more than half the world's coral reefs are likely to be destroyed by climate change. This reflects the sort of impacts each ecosystem, from the poles to the equator, will face:

> If sea levels were to rise at a pace faster than corals could build their reefs upward, eventually light conditions would be too low for the zooxanthellae to continue photosynthesis. On reefs near low-lying coastal areas, sea level rise would likely increase coastal erosion rates, thus degrading water quality and reducing light penetration necessary for photosynthesis and increasing sedimentation that smothers and stresses coral animals. Losses of coral reefs would mean losses in the high biodiversity of these systems as well as the fisheries and recreational opportunities they provide.[15]

The PEW Centre describes changes to population ranges and new mixes of marine species that will have unknown impacts. If climate change doesn't kill entire populations outright, those species will face difficult challenges. Species able to adapt to new predators and/or new prey will survive, while others may be left with an inaccessible food supply or ravenously successful predators. Such changes are largely unpredictable as are their economic impact to fisheries all over the world.

Quakes

Recent discussions in the geology community are drawing connections between glacial melting and the triggering of earthquakes, volcanoes and activity beneath the ocean surface. As the earth warms and glaciers melt, as much as a kilometre of ice may be removed from the earth's crust. With removal of pressure from the earth's surface, quakes and shifts in the tectonic plates should be expected. Additionally, the extra weight from melt waters will be distributed over the entire surface of the ocean, having little impact on tectonic plates in comparison to the removal of glacial sheet.[16]

It is clear that one change can precipitate another, causing an influential chain of events impacting our communities, ecosystems and the earth. Much of the predicted effects are unknown in their severity and scope. In some cases, as in species extinction, there is no turning back. In other cases there is opportunity for repair, notably the devastation of New Orleans. One climate scientist describes this idea of "tipping points":

> "...it seems more appropriate to view the system as having multiple tipping points and thresholds that range in importance and scale from the smallest ecosystem to the size of the planet. As the system is forced into new configurations more and more of those points are likely to be passed, but some of those points are more globally serious than others."[17]

It is clear that one change can precipitate another, causing an influential chain of events impacting our communities, ecosystems and the whole earth.


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CHAPTER 5

Taking Action

HOW COOL IS THAT!

The International Process

United Nations

The world started to get serious about climate change in 1988 when the United Nations formed the **Intergovernmental Panel on Climate Change** (IPCC), which began to pull together the scientific assessment of global climate change.

Heads of government approved the **UN Framework Convention on Climate Change** (UNFCCC) at the 1992 Earth Summit. The FCCC identified climate change as a serious problem and solidified international commitment to finding a solution leading ultimately to a stabilization of greenhouse gases in our atmosphere.

To date, 194 countries have ratified this convention while only six have not. Signing of this convention indicates a theoretical agreement of a *"differential responsibility"* to reduce emissions. In other words, since developed countries have created over two-thirds of the GHG concentration, they have an increased responsibility in cleaning things up.

The **Kyoto Protocol** is a tool of the UNFCCC. It was adopted by 156 nations in 1997 and came into force on February 16, 2005.

This agreement legally binds the participating industrialized countries to cut their combined greenhouse gas emissions to five per cent below 1990 levels between 2008 and 2012.

The U.S. and Australia refused to sign the Kyoto Protocol and as a result they have been left out of official discussions, which makes global progress problematic. As an alternative they have proposed non-binding talks on a climate change agreement that would eventually replace Kyoto. Because of Kyoto's foundation in the UNFCCC, and its principle of differential responsibility, many current signatories and NGOs see the Kyoto process as a better route, and continue to attempt to draw in the U.S. and Australia.

Climate Action Network International

A coalition of over 287 non-governmental organizations, the **Climate Action Network International**, is working to promote sustainable solutions to climate change and inform the Kyoto process.

Canadian members include well-known organizations like the Sierra Club of Canada, the David Suzuki Foundation and the Pembina Institute. They have developed goals for emission reduction, considering the devastating consequences of a 2°C rise above pre-industrial temperatures. Consequently, the Climate Action Network International concluded "climate action must be driven by the aim of keeping global warming as far below 2°C as possible (relative to the pre-industrial level)."

Global Climate Equity and Carbon Trading

The Kyoto Accord may be the best opportunity to strike an equitable agreement between the North and the South. If we think of the atmosphere as a commonly held resource that cannot be divided among nations, we begin to see the global nature of the problem. We also see that some nations have used this resource more than others, i.e. industrialized countries (the North) which put more CO_2 into the atmosphere than underdeveloped countries.

In principle, the onus should naturally fall on the North to remedy this problem and reduce emissions. However the South is rapidly industrializing and will therefore increase their GHG emissions. The numbers show we will never stabilize global warm-

ing at the targeted 2°C, if the South doesn't also take part in emissions reduction.

One solution to this dilemma about equity and the atmosphere is to imagine a per capita distribution of atmospheric space. Some analysts suggest creating a system based on per capita "shares" of the atmosphere, enabling less industrialized countries to sell unused shares, and use the money to support clean energy and sustainable development.[2]

This process is known as emissions or carbon trading. The net result is that the North pays for clean development in the South while getting a break on their emissions reduction. The market in carbon trading is now off and running. There have been justified criticisms and the issue of equity is not fully resolved.

Watchdog groups have urged developing countries to avoid projects in which the principal developer is from a non-Kyoto signatory country like the U.S. or Australia. But if climate repair is ever to happen we must find ways to make such mechanisms work.

Humanity is conducting an unintended, uncontrolled, globally pervasive experiment whose ultimate consequences are second only to global nuclear war.[1]

Toronto Conference 1988

Canada and Kyoto

Canada ratified the Kyoto Protocol and accepted a challenge to lower its greenhouse gas emissions to 6% below 1990 levels by 2012.

However, Prime Minister Harper is clear that he does not expect Canada to achieve the committed reductions. Yet he continues to maintain he is not abandoning Kyoto. At the same time he has nothing but praise for the tar-sands development. In fact, the project is the single largest contributor to growth in Canada's GHG emissions.[3]

Any Day Now: The Harper Made in Canada Plan

On the campaign trail in January 2006, the Conservatives stood out by their lack of an environmental platform. Harper openly rejected mandatory timetables and targets that had been set out in the Kyoto Protocol. As with the Bush administration in the U.S., he proclaimed that they would create new, non-binding targets for industry and the provinces.

With each new piece of research, the expected effects of global warming become clearer, more urgent and more disturbing.

Dr. David Suzuki

What is clear since the formation of the new government is that the Conservatives do not have a clear plan one way or another. The new Environment Minister, Edmonton-Spruce Grove MP Rona Ambrose, has complained about the flaws of the Kyoto Accord, claiming the reduction targets are unrealistic and impossible to meet. Environment Canada has eliminated their main climate change website just this summer during the writing of this document and recently replaced it with a banal statement of commitment. The well-known One-Tonne challenge initiative has been put on hold by Environment Canada, but has luckily been taken up by a non-profit group. Other initiatives were cancelled altogether on March 31, the end of the fiscal year.[4]

Harper, when questioned about the impact in our Arctic territories, claimed that action would be announced this fall in conjunction with the consultation of Indian and Northern Affairs. He also stated that territories and provinces will be regularly consulted about the *Made in Canada Plan*, with announcements this fall.[5, 6]

Harper and his cabinet are simply confounding the progress of any solutions that were in place, and stalling with his façade of a *Made in Canada Plan*. With Canada's legal obligation to the Kyoto Protocol and Ambrose holding the Presidency of the Conference of Parties to the United Nations Framework Convention on Climate Change for the next year, Canadians need to push this issue front and centre.

For any available solutions to become part of Harper's proposed plan, solid action needs to be taken immediately by the federal leadership.

Canada Carries On

Nothing can stop politicians like Stephen Harper and George Bush from playing their own perverse political games with the issue of global warming. Fortunately, nothing can stop those of us who want to take the issue seriously either. Many efforts are moving forward to combat global warming—in spite of our politicians.

The Soft Energy Path

Decentralization of our power system is vital to creating effective alternative energy options. A soft energy path is being recommended to meet our Kyoto emission reductions. A soft energy path includes renewable energy, diversification and the development of technology that is easy to understand and operate. "Conservation is made equal to deprivation. But in most cases the situation is just the reverse. Soft path techniques not only cut energy use but also provide a better service." [7]

One example of a soft path system is "district energy". Fossil fuel power plants produce twice as much heat as electricity. With a district energy model this excess heat is redistributed, not wasted through release into the environment. It is piped to other buildings in the form of steam or hot water to heat or do work for adjacent industries. There are successful examples of district energy being used in communities and industrial parks all over the country: Vancouver, Montreal, Toronto, Halifax, Hamilton, Watson Lake (Yukon) and Fort McPherson (NWT).[8]

District energy can also be combined with solar and wind technologies. Waste heat is used to manufacture biodiesel, which can replace fossil fuel for vehicles and industry. To explore how the soft path can work, Clare Municipality in Nova Scotia sent a delegation to Gussing, Austria to study possible solutions. In the 1980s, Gussing was a depressed region whose purchase of fossil fuels was a drain on the local resources. To solve matters they developed a sustainable energy plan and turned things around. Today they produce more heat and electricity than the town needs and 8,000 tonnes of biodiesel per year.[9] Examples like this exist all over the world. We have the technology *now*, we just need the will to take action.

Moving toward a soft path means a decentralization of our power supply systems. Municipalities that take action will see the immediate benefits, just as households realize the benefits of applying weather stripping on a drafty doorway. This is the strength of grassroots change. Several municipalities across Canada have taken leading roles in tackling local GHG emissions. They will become more efficient in their use of power and save money in the long run.

Solar Power in Canada

Photovoltaic (PV) panels are being installed on roofs all over Canada, from universities to mountain cabins. But the projects have been relatively small and the investment burden is comparatively high for those with the vision to install them. Germany, a highly industrialized country, has given a boost to stimulate the process of incorporating PVs into the country's power grid. Providing what is known as "standard offer contracts", the government guarantees that you can sell solar power back to the grid at 62 cents a kilowatt hour. This kind of buyback makes installation costs manageable and decreases the payback period.

In the spring of 2006, Ontario's Power Authority (OPA) and the Ontario Electricity Board (OEB) finally created the conditions for an Ontario Standard Offer Contract program.[10] Under the program the Ontario Power Authority will pay 42 cents/kWh. This contract also includes rates for wind, biogas and micro-hydro projects.[11] But with caps on the maximum size of solar projects, the OPA and OEB don't go far enough to encourage replacement of coal and nuclear.

Wind Power in Canada

SaskPower in Saskatchewan has addressed 13 company proposals for wind energy to total around 800 GW hrs/y. SaskPower is also supporting heat recovery and biogas generation plants. These efforts have already seen a 5% reduction in GHGs for Saskatchewan.

The Canadian Wind Energy Association reports that "Canada has now become the 12th country in the world to surpass 1,000 Megawatts (MW) of installed wind energy capacity. With 1,049 MW of installed capacity now in place, wind energy produces enough electricity to meet the needs of more than 315,000 Canadian homes. As of June 2006, Canada had installed a record 365 MW of wind energy capacity this year, and this number will increase further before the year is out."[12] In the past, the provinces have been supported with federal funding for the development of wind energy. In fact B.C. is the only province without some wind generation capacity. But the federal government has recently frozen funding to further wind installations, based upon a review of its efficacy and its place in Canada's overall energy plan.[13]

Hydrogen Fuel Cells in Canada

Hydrogen fuel cells generate electricity by electrochemically combining hydrogen and oxygen; they are highly efficient energy-conversion devices. In case you were thinking this was science fiction and decades down the road, it isn't! It's here and now! *Hydrogen & Fuel Cells Canada* is a national association for the growing hydrogen and fuel cell industry. Their mission is focused on accelerating the development and commercialization of Canada's world-leading hydrogen and fuel cell industry.[14]

The fossil fuel and nuclear industries that are no longer in denial about climate change are investing in hydrogen production. We must be clear that hydrogen fuel produced through the burning of fossil fuels doesn't reduce GHGs. And hydrogen fuel produced with nuclear power comes with the usual host of sustainability issues that nuclear energy brings. Hydrogen cells, in order to be our solution to climate change and clean air, need to be powered by hydrogen created by renewables.[15]

The *Hydrogen Village* project promotes a variety of applications for fuel cells, demonstrating its viability for meeting our energy needs throughout our society. Hydrogen powered fuel cells are already running Purolator fleets, Bell switching stations, university residences and zero emissions forklifts and utility vehicles. Not all of these options are using fuel produced by renewable energy technologies, but that should be the ultimate aim.

A wind powered electrolyser producing hydrogen for vehicle refueling is located in downtown Toronto. This is the vision that needs to be propagated throughout Canada.[16]

Hydrogen powered fuel cells are already running Purolator fleets, Bell switching stations, university residences and zero emissions forklifts and utility vehicles.

The 2°C Limit

Many Canadians want to do better than our prime minister. They are working to have us do more than just meet our Kyoto commitments. They want us to reduce global warming as much as possible, setting an increase of 2°C as the absolute upper limit. To allow global warming to rise beyond a 2°C increase is to invite environmental disaster beyond our imagining.

The report, Kyoto and Beyond, sets out goals to carry us far beyond the 2012 Kyoto targets.

Many experts are calling for "deep reductions" to first meet Kyoto targets and then secure a future free from climate disaster. The David Suzuki Foundation and the Pembina Institute have proposed two clear goals to guide medium and long-term planning to combat global warming:

- a reduction in Canada's GHG emissions to 25% below the 1990 level by 2020
- a reduction in Canada's GHG emissions to 80% below the 1990 level by 2050.

Kyoto and Beyond

The report, *Kyoto and Beyond* (KB), sets out goals to carry us far beyond the 2012 Kyoto targets. It outlines a five part, step by step path to a 50% reduction by 2030, using today's technology and energy efficiency designs currently in existence. The five steps are:

1) Doubling the thermal efficiency of residential and commercial buildings;
2) Doubling the fuel efficiency of the truck fleet and tripling it for the passenger car fleet;
3) Doubling the average efficiency of electrical devices, including lighting, motors and appliances;
4) One percent per year improvement in the energy efficiency of industrial output; and
5) Phasing out of coal- and nuclear-powered generating plants, replacing them with soft path options.

Residential Buildings

Homes require efficiency standards for doors, windows, insulation and plumbing fixtures. Measures may come from improved provincial building codes and municipal governments, with incentives for retrofits coming from the federal government. Building to R-2000 energy efficiency standards only costs 2-4% more to build but results in a 30-40% savings in energy bills.

The report envisions hydrogen fuel cells supplying electrical needs for 20% of homes and 35% of apartments by 2030. The Energy Star program plays an important role in promoting high-efficiency furnaces and appliances as mid- and low-efficiency models are phased out. A redirection of

waste heat in multi-family buildings and solar heat design could significantly reduce emissions.

Eliminating or curbing urban sprawl will go a long way towards emissions reduction. Automobile dependence, lack of cycling and pedestrian routes make suburban sprawling communities energy-inefficient. Urban core redevelopment, in-filling and the creation of pedestrian routes and market places will create smog-free cities that are pleasant to live and work in.

Commercial and Institutional Buildings

Many institutions are undergoing "sustainability audits" to initiate plans of action. With growth in this sector, any new buildings can implement best practices and "green procurement" policies, and energy efficiency retrofits.

New buildings can be built within LEEDs standards with each institution setting achievement levels for future development. For example, the University of Ottawa has set the LEEDs silver level as the minimum for any new buildings on campus.

District energy systems, hydrogen fuel cells and combined power systems need to be encouraged through incentive programs and partnerships.

Lighting standards need to be enforced for light fixtures, including Energy Star standards.

A federal revolving fund would finance building upgrades modeled on the Better Buildings Partnership in Toronto.

The Mountain Equipment Coop building in Ottawa has reduced their energy consumption by 40% since 1991, saving $22,679 per year.

The federal government's implementation of a partnership fund would encourage action by provincial and municipal buildings. All three levels of government should show leadership in operations and energy efficiency.

Passenger Transportation

Decreasing the carbon intensity of fuel, such as the development of high-octane fuels, has worked in the past, but efforts have been discontinued. Similarly, there is room for improved fuel efficiency in cars.

Efficiency standards need to be set for each vehicle category. Federal government standards should be set several years in advance to smooth the industry transition.[17]

"Feebates" could be offered to reward the purchase of fuel efficient vehicles.[18] Investment in public transportation, bike racks, telecommuting options for employees and transit pass subsidies are a few simple ways to meet the passenger transportation GHG reduction targets.

Freight Transportation

Federal incentives to switch to rail freight transportation would reduce some of the emissions from long-range trucking. Similar to passenger cars, efficiency standards can (and are) being applied to truck fleets.

Canada Post and FedEx have employed prototype vehicles that reduce emissions by 40% and 90% respectively. Fuel standards at the pumps can also be enforced to reduce emissions. Although the infrastructure is not yet fully developed, hydrogen fuel cell vehicles can also be introduced into fleets.

Industrial Sector and the Large Final Emitters

With planning and insight into the specific operations of each industrial subsector, specific gains in efficiency can be made. For example, Sterling Pulp Chemicals Ltd. has reduced fossil fuel consumption by a stunning 94%. Waste hydrogen is now turned into fuel for the company's steam plant and an initial investment of just over $1 million produced an annual return of $2.28 million of savings a year.

Bringing the Large Final Emitters (LFEs) onboard is key to meeting any of our Kyoto goals and is probably the biggest policy and planning task for Canadians. The LFEs include primary energy producers (fossil fuel production), electricity producers (hydro and nuclear) and selected mining and manufacturing industries.

Reduction of emissions in the fossil fuel industry would include methane capture, leak detection and repair, re-injection of acid gases and CO_2 and increased use of co-generation and heat recovery.

BP (British Petroleum) is an example of what a fossil fuel company with vision can accomplish. They have reduced their emissions by nine megatonnes in three years, eight years ahead of their target. They estimate that these energy efficiency measures have added $US 650 million to their operations value.[19]

With regard to electric power, following a soft energy path will lead to the greatest reduction in GHG emissions. The most significant gains will be made by decentralizing electricity production by moving to co-generation, fuel cells, solar and wind, complemented by small hydro projects. "Canada should have some 100 billion kilowatt hours of surplus hydro power available in 2030 for export or for hydrogen production."[20]

Canada's most important source of new energy has become increased energy productivity—that is, energy saved through conservation and a more efficient economy.

Non-Energy Emissions

Not all GHG emissions are the result of fossil fuel consumption. Replacing ozone-depleting refrigerants and changes to the aluminum industry will reduce a source of GHG emissions that is sometimes overlooked.

Similarly, nitrous oxide generated as a waste product can be destroyed or recycled to avoid its release into the atmosphere.

Methane emissions from landfills can be captured and used in electricity generation. Of about 800 landfills across Canada, only 16 capture and convert the methane to electricity. Environment Canada is supporting the expansion of this program.[21]

Other sources of methane, particularly agricultural activities, can reduce emissions with better solid waste management, manure management and a change in livestock feed.

Core Strategies

Kyoto and Beyond simply presents a core strategy of efficiency. Some continued use of fossil fuels is inevitable, but burning them efficiently is crucial to GHG reduction. In fact Canadians have been doing just that since 1970.

"Over the past generation, Canada's most important source of new energy has been increased energy productivity—that is, energy saved through conservation and a more efficient economy."[22]

Solutions need to come from all sectors and all levels of government. With an integrated plan we can meet and exceed our

Unions have a unique opportunity to communicate with individual Canadians about climate change.

short-term Kyoto commitment and be well-positioned to move into the 2012 phase without hardship to Canadians.

Union Action: Imagine the possibilities

There are more than 2.2 million Canadians in unions—about one union member for every 15 of us. The potential for communication and action within unions and by us in our home communities is unmatched. If we love this planet we will tap that potential to join the front ranks of those already working to keep our cool and keep our earth a fit place for humans and all living things.

Member Education

Unions have a unique opportunity to communicate with individual Canadians about climate change. Clear educational materials and presentations at meetings and conferences will drive home the need for deep emissions reductions and immediate change.

Environment Canada has created an easy to use One-Tonne Challenge program at: www.eartheasy.com/article _ canada _ challenge.htm.

Member driven Sustainability Committees can provide workshops that guide people through the program to make changes at home and with their families. Many communities have local grassroots groups that would be happy to make workplace presentations about climate change and local initiatives. These committees would be abreast of rebate programs offered by various levels of government that support energy efficiency at home, promoting these incentives among their members.

Most valuably, union offices can model plans for energy efficiency and emission reductions onsite. Brag about your successes in emissions reductions and lead the way!

A Sustainable Workplace

The viability of the institutions and industries in which we work is crucial to job security. To be employed at a job where the work could end at anytime is unstable. With climate changes occurring at a global level, and unpredictable shifts occurring

regionally, there will be chain reactions influencing our economies and our communities' needs; everything from changing health care, emergency services, market stability and lifestyle shifts. There is uncertainty in every workplace throughout the next decades.

Due to the global nature of the problem, a global solution is called for. This reality puts the burden on each workplace and each one of us. Workplaces, where we gather and collectively use energy, can have the largest emissions but also the biggest impact on GHG emission *reductions* when steps are taken. Unions, being networks of workplaces, can create an effective policy to reduce emissions on a broad scale. Information on effective strategies can be shared and save time and resources from one locale to another.

There is growing acceptance that reducing emissions should only be part of a larger movement to create a sustainable world where multiple factors, beyond emissions reductions, are considered. The definition of sustainability created by the Brundtland Commission has three areas of focus:

1) Ecological integrity - the planet as a closed system with finite resources. It requires living within the carrying capacity of ecosystems in such a manner that human activities, resource consumption and waste production do not undermine the ability of the planet to sustain the well-being of all forms of life.

2) Social equity - fair and equitable distribution of wealth that meets basic needs for all, which is respectful of human rights, and which includes broad and meaningful participation by individuals in decision-making in order to nurture community vitality.

3) Economic prosperity - a triple bottom line approach that considers economic feasibility, ecological limits and social needs in financial decision-making. It also requires moving beyond considering only the expansion of wealth toward ensuring equitable distribution of wealth.

This approach is starting to be used in dozens of universities across North America. Spearheaded by students to put pressure on university administrations, baseline studies are first generated to assess the current performance of the institution. The Sierra Youth Coalition has developed a framework by which uni-

versities and colleges can evaluate 10 areas of concern. These baseline studies can then be used to create a plan and policy to improve and move toward a sustainable institution. With a little reflection, union Sustainability Committees could tailor this framework to suit specific workplaces. With hard data from these baseline studies committees can approach employers with specific suggestions for changes to operations.

With regards to the very specific focus of this report we will look at actions that will reduce GHG emission. When developing a strategy, first identify all the sources of energy expenditure: power demands, heating/cooling, transportation. These areas directly influence carbon dioxide emissions. Considering water consumption would be prudent due to the expected impact on the global fresh water supply. The waste stream at your workplace influences landfill sites and methane production.

Energy Expenditure

Lobbying for changes within a workplace can be very powerful. When members call for efficient changes to lighting, heating and cooling systems, employers are more likely to implement them. Training for employees is essential where new equipment, appliances or machinery are installed. With member commitment to these technological shifts and acquisition of new skills, transition will be smooth and the cost savings will be sooner.

Sustainability Committees can lead institutions to choose energy efficient options, just as students have pressured universities to make changes and take leadership roles.

Vehicle Emission Reductions

Members should bargain for transit passes, so they won't have to drive their cars to work. Bike shelters and lock-up facilities will make cycling to work a more viable option. Telecommuting options for members may be expanded so that certain tasks can be performed out of home offices. Sustainability Committees should promote Canada's Clean Air Day, and the Commuter Challenge (www.commuterchallenge.ca/english/index.aro) which encourages a friendly competition for cycling, walking and the use of public transit options the first week of June each year.

Tele- and video-conferencing can go a long way to reducing vehicle emission through travel to meetings. This option also eliminates travel time and time spent away from families.

Water and Waste

Committees should run campaigns to demand low-flush toilets in all washrooms. Ensuring access to water fountains as opposed to vending machines that sell bottled water could be the focus of a union campaign. The Polaris Institute has ready-made campaign materials to lobby employers for this right to free water: www.polarisinstitute.org/polaris_project/water_lords/water_lords_index.html.

Waste diversion programs should be implemented at each workplace. This type of program is entirely dependent on grassroots participation and quality separation of waste streams at the source. It is here that member committees are invaluable in educating each employee. The development of composting programs, where municipal systems do not exist, is also an effective waste diversion strategy.

Political Action

Permanent reduction in Canada's emissions needs to be backed up with tighter government regulations on industrial emissions and the energy efficiency of vehicles and appliances. Sustainability Committees in every workplace will multiply the results when working with groups like the Canada Clean Air Network to lobby the government for these sorts of regulations. The Suzuki Foundation currently has a simple postcard campaign that each and every workplace should encourage their members to sign.

Finally, International Solidarity Committees should look at assisting workplaces in developing countries to move effectively to soft energy paths. Using the Clean Development Mechanism (CDM) and Canada's need to be engaged in carbon trading to meet its reduction targets, union International Solidarity Committees can act as active supporters for quality projects that create sustainable workplaces in developing countries.



AFTERWORD

The Skeptics

IF THEY DON'T KNOW, YOU JUST CAN'T TELL 'EM

THERE IS NO LOGIC TO IT. And no common sense. But that doesn't stop the global warming skeptics: people who cannot, or will not, admit the threat of global warming.

Science writer Lydia Dotto, in her book *Storm Warning: Gambling with the Climate of Our Planet*, sets out exactly why this phenomenon seems so deliberately wrong-headed:

> ...there is *no question* that human activities emit greenhouse gases into the atmosphere, or that atmospheric concentrations of greenhouse gases are increasing as a result, or that greenhouse gases cause warming. Therefore, logically, there is *no question* that human activities contribute to warming the climate. And since there is also *no question* that greenhouse gas emissions from human activities are currently increasing every year, we know that their climate influence is bound to grow.[1]

Still there are doubters and critics. Their questioning of the common consensus on the threats of global warming fall into three main catagories:

- Lack of a scientific consensus;
- The Global Climate Coalition and Exxon's Friends; and
- The Hockey Stick Graph.

More than 2,000 of the world's top climate scientists agree that human activity is responsible for the changing climate.

Questioning the Scientific Consensus

The critics argue there is no consensus among scientists regarding global warming and climate change. The road traveled in accumulating the science and building a consensus has been a long one. After nine years of growing concern in the scientific community about potentially serious changes to the global climate, the United Nations Environmental Programme (UNEP) and the World Meteorological Organization (WMO) established the Intergovernmental Panel on Climate Change (IPCC) in 1988.

The panel produced scientific reports on climate change to inform, not dictate, policy making for governments. They produced three reports compiling and summarizing climate change science to assist the process of emissions reduction and preparation for change by each country of the world. Their last report in 2001 clearly identified climate change as human-induced and accelerating. More than 2,000 of the world's top climate scientists agree that human activity is responsible for the changing climate. Their findings have been publicly endorsed by national academies of science in Brazil, Canada, China, France, Germany, India, Italy, Japan, Russia, the United Kingdom and the United States.

As Dr. Robert Watson, then Chairman of the IPCC, clearly stated in 2001, "The overwhelming majority of scientific experts, whilst recognizing that scientific uncertainties exist, nonetheless believes that human-induced climate change is already occurring and that future change is inevitable."

A recent study looked at every article published on climate change in peer-reviewed scientific journals over a ten-year period (between 1993-2003) to examine the level of consensus. The study found that not one of the 928 articles disagreed with the position that climate change is *happening* or is *human-induced*.[2]

The Society of Environmental Journalists featured an interview with two journalists in 2006, who identified the lack of skeptics in the European media, agreeing that the phenomenon seemed to be entirely a U.S. thing.

Well, that's the thing, and this is a key point. The reason we don't have these voices in Europe is not because we aren't balanced. We do try to be balanced. But most journalists and media outlets in Europe have taken the view that putting in a voice that is right out

on the wildest extremes does not represent mainstream science. And by putting them in the story and giving them equal space and giving them equal validity, you're suggesting that they're equivalent; and they're not.[3]

Canada's media too, liberally publishes the skeptical views, but we should keep in mind our biases and the influence of the western oil barons.

The Science Education Fund is a Canadian industry funded groups of nay-sayers. Set up by some of Stephen Harper's associates and the fossil fuel industry, we can clearly see the connections and the influences that slow down our Canadian progress to reducing emissions. In an attempt to skew the "optics" of being directly funded by oil and gas, a University of Calgary political scientist, Barry Cooper, set up this fund with anonymous donors, through the University.[4]

The fund covers travel expenses for speakers expounding on the "flawed" science of Climate Change. A few men, like Tim Ball, a retired geography professor, travel around Canada spreading doubt about climate change science and the IPCC's research. It also paid for the production of a video, Climate Catastrophe Cancelled. This film includes statements from Canada's loudest climate skeptics, including Professor Ball, University of Ottawa hydrologist and paleoclimatologist Ian Clark, Carleton University paleoclimatologist Tim Patterson, University of Ottawa lecturer Tad Murty and retired meteorologist Madhav Khandekar who is affiliated with the oil-industry-funded Cooler Heads Coalition.[5]

It must be understood that these views are not from researchers who are publishing in peer reviewed scientific journals. Critique of research is crucial to good science and understanding complex phenomenon such as climate. But when critics aren't using science to re-examine findings, replicating or refuting previous results, the critique is nothing more than speculation and opinion. These opinions are bought and paid for by biased industry.

The more press these lone voices get in the media, the more public confusion and doubt there is. This delays action because it delays public pressure on those responsible, our federal government.

The critique is nothing more than speculation and opinion bought and paid for by biased industry.

Exxon Mobil funds close to 40 U.S. organizations that work to discredit mainstream scientific findings on global climate change.

Exxon's Friends: The Global Climate Coalition

Since the 1990 first draft document on the threat of human induced global warming, there have been "observers" from the coal, oil and chemical industries, nick-named the "Carbon Club". Scientists on the payroll of Exxon attending climate conferences have worked to cast doubt on conclusions that implicate the burning of fossil fuels with global warming. Counter organizations such as the World Climate Council, the Global Climate Coalition and the Information Council on the Environment all provide non-scientific critique and sometimes blatant misinformation. All these parties are set on undermining the scientific consensus and creating enough doubt in the public eye as to the certainty of climate change, slowing any forward move in policy development towards emissions reduction.[6, 7]

Exxon Mobil funds close to 40 U.S. organizations that work to discredit mainstream scientific findings on global climate change. They include media outlets, consumer, religious and even civil rights groups. Having no scientific arguments, they deny facts, stall for definitive results, misrepresent the facts, and express concern over "unfair" policies that attempt to reduce emissions.[8, 9]

Industry's biggest concerns are loss of profits and competitiveness. They fear that emission reductions or penalties will destroy profits. This view is short sighted if not unfounded and unrealistic. On the plus side, several major oil companies including Shell, Texaco and British Petroleum, as well as automobile manufacturers like Ford, General Motors and DaimlerChrysler, have now left the Global Climate Coalition (which became inactive after 2002).[10] These companies have taken initiatives to change paths and develop a sustainability policy, investing in research and development of alternative energy. British Petroleum openly discusses wind power and reduction of carbon emissions on the home page of their website: www.bp.com.

National economic concerns in various developed countries are focused on different expectations between the North's and the South's responsibility in emissions reduction. It is impossible to ignore that Northern developed countries have greater emissions and are responsible for the majority of GHGs in our atmosphere. The UN Framework Convention on Climate Change

(UNFCCC), signed by all 154 countries in attendance at the 1992 Rio Summit, contained a principle of "differential responsibility" and stated that limiting development opportunities for the South would be unfair.[11]

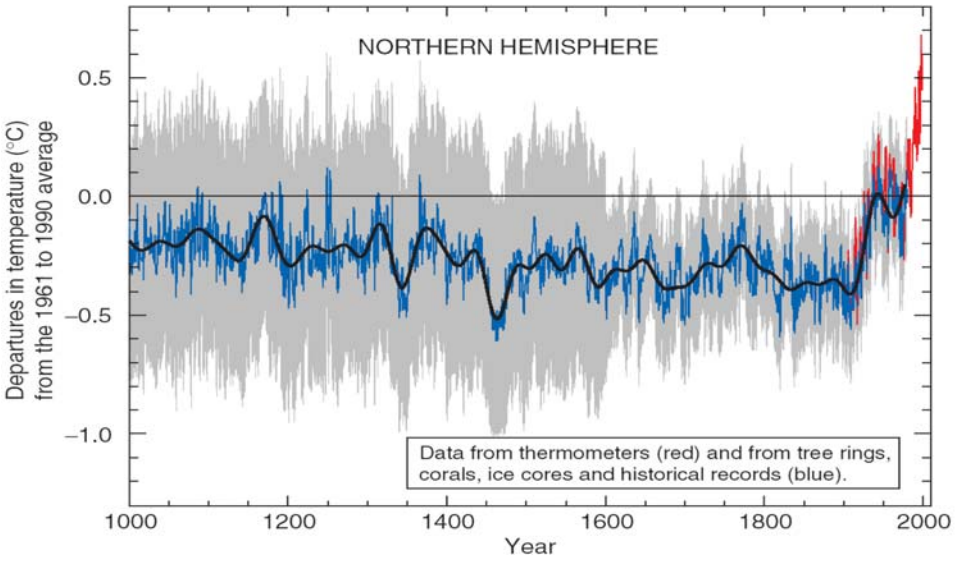
When developing global policy, various countries balked at taking action. Over ten years of negotiation, developed nations have stepped back from settling on a global agreement, but today the U.S. is the major principled hold out, although we have yet to see declines from any major GHG contributor.

A Republican Party statement from 1999 reveals a key source of U.S. political concerns: "We deplore ceding U.S. sovereignty on environmental issues to international bureaucrats and our foreign economic competitors."[12] This is not about the science; it is about politics and the bottom line.

This is not about the science; it is about politics and the bottom line.

Questioning the "Hockey Stick" Graph

Skeptics have questioned the statistical validity of temperature analysis of the data from the past 1,000 years.



Two Canadian critics, Dr. McKitrick, an economic professor from the University of Guelph, and Steve McIntyre, a retired businessman, have made the news by expressing outrage about the IPCC's global temperature assertion. They have no doubt that this last decade is record breaking with regards to the last 400 years, but

they question an assertion of "record breaking" can be made about the last 1,000 years.[13]

In a National Post comment piece by McKitrick and McIntyre, it was noted that a U.S. congressional Energy and Commerce hearing ruled that the IPCC may have overstated the confidence of findings from the last 1,000 years.[14]

However, the real question is would the results have looked any different if the data was analyzed differently? Would you still get the "hockey stick" shape that indicates rising temperatures beyond the normal warming and cooling trends? Running the data through different statistical analyses has shown the same trend. In the original 1998 paper (by Mann, Bradley and Hughes) they express uncertainty going back further than 1400, due to sparse data.[15]

Climate scientists report that "As of now, all of the 'Hockey Team' reconstructions... agree that the late 20th century is anomalous in the context of the last millennium, and possibly the last two millennia."[16]

Ten of the Best

The David Suzuki Foundation says these are the

10 MOST EFFECTIVE

ways we can help conserve nature
and improve our quality of life.

1. **Reduce home energy use by 10%**
2. **Choose an energy-efficient home & appliances**
3. **Don't use pesticides**
4. **Eat meat-free meals one day a week**
5. **Buy locally grown and produced food**
6. **Choose a fuel-efficient vehicle**
7. **Walk, bike, carpool or take transit**
8. **Choose a home close to work or school**
9. **Support alternative transportation**
10. **Learn more and share with others**

DO ANY THREE

and you'll make a difference.
Do more—make more of a difference!

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