

Climate Futures

Pathways for Society

Edited by
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New Zealand
Climate Change Research Institute
Te Pūtahi Hurihanga Taiao



TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

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Dr Lee Seng Tee



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Acronyms

| | |
|-----------------|--|
| BAU | Business as usual |
| CFCs | Chloroflouorocarbons |
| CO ₂ | Carbon dioxide |
| ETS | Emissions trading scheme |
| FoI | Freedom of information |
| GDP | Gross domestic product |
| GEMs | G20 emerging markets |
| GHGs | Greenhouse gases |
| IPCC | Intergovernmental Panel on Climate Change |
| OECD | Organisation for Economic Co-operation and Development |
| R&D | Research and development |
| RoW | Rest of world |
| SDI | The Strategic Defense Initiative |
| UN | United Nations |
| UNFCCC | United Nations Framework Convention on Climate Change |



Foreword

An ongoing dialogue

Climate change raises questions for society that go far beyond climate science itself and lead to basic questions about how society should plan for likely climate futures.

We need new ways of addressing the likely consequences of climate change in the next decade, as well as ways for future generations to both limit and deal with the consequences.

Our response to climate change requires a clearer social perspective. We need more collaboration between different sectors of society, and for this to be integrated with contributions from scientists and policymakers. Only then will we be able to change the path we are on.

We organised the Climate Futures Forum to launch an ongoing dialogue—across society and generations—identifying pathways to different climate futures.

The two-day Forum covered four policy-relevant and interdisciplinary themes:

- Climate change and society's challenge
- Communication between the science community and society
- Human behaviour and the capacity to change
- Towards durable decision making

Our response to climate change requires a clearer social perspective.

We organised the Climate Futures Forum to launch an ongoing dialogue—across society and generations—identifying pathways to different climate futures.



The wide-ranging perspectives across the Forum presentations will not be shared by all. Some are controversial but we have included them all to foster open dialogue.

After a mihi from Te Papa and a welcome by the Mayor of Wellington, the Minister for the Environment opened the Forum. Two youth perspectives set the challenge for the Forum. Each of the four thematic sessions began with overviews from speakers, followed by group dialogue sessions between participants and the speakers, and a final summary session. The Forum concluded with a synthesis of the two-day dialogue. You can watch videos of all of the presentations at the Forum on our website¹.

During the Forum, participants recorded their comments and these have been dispersed throughout the text to create continuity with the ongoing dialogue from the range of perspectives. The wide-ranging perspectives across the Forum presentations will not be shared by all. Some are controversial, but we have included them all to foster open dialogue.

To maximise the public dialogue and attract a wide range of participants, we also organised a number of outreach activities, including:

- Sir Lloyd Geering's reflections on the legacy of our religious past as we face future climate change (a seven-minute film)
- a Café Session moderated by Ian Wedde: Expanding our thinking on climate change—What can I do? What do I need to do?
- a Breakfast Session moderated by Chris Laidlaw: Responding to the big risks, building resilience into our 'capitals': natural, built, social, economic, and political
- a conversation between three noted climate change writers—UK's Fred Pearce (The Climate Files), USA's Erik Conway (Merchants of Doubt), and NZ's Gareth Renowden (Hot Topic), moderated by Sean Plunket.

Beyond the Forum, several speakers were interviewed for public radio and television and several newspaper feature articles appeared. Gareth Renowden also reviewed the Forum on his blog, Hot Topic².

¹ www.victoria.ac.nz/climate-change

² www.hot-topic.co.nz

This record of the Forum continues the dialogue. It captures the Forum presentations and group dialogue sessions, along with the invited comments from participants. It is designed to encourage reflection on the Forum and continues a conversation that we hope will be ongoing.

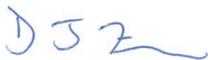
We at the Climate Change Research Institute will continue facilitating this effort to increase understanding of the climate change challenge to society, finding ways in which individuals and wider society can play a role in ensuring a sustainable future for humankind.

As Ian Wedde, the Chair of the Café Session, said when trying to capture the essence of the conversation:

"Idea of flows, connectivities, networks, and overlapping embodiments ... leave you with the image of the mantle of water—he korowai o te wai— ... to get our conversations flowing."



Professor Martin Manning, Founding Director
New Zealand Climate Change Research Institute
Victoria University of Wellington
New Zealand



Professor Dave Frame, Director
New Zealand Climate Change Research Institute
Victoria University of Wellington
New Zealand

December 2011

This record of the Forum continues the dialogue ... It is designed to encourage reflection on the Forum and continues a conversation that we hope will be ongoing.



...our emissions are still growing and our emissions trajectory is still frightening, and these ultimately are the only measures of success or failure that really matter.

Prologue

Intergenerational perspectives

Youth perspectives

Jinty MacTavish
Dunedin, New Zealand

Generally, it's my preference to be positive. It's a much more agreeable way to be. But I have been asked to speak from the perspective of young people and, to be frank, to any young person who knows anything much about climate change, our situation looks pretty grim. It looks grim because, despite a lot of words—emissions trading, Cancun Accord, research and development (R&D) in agriculture, 'fairness' in forestry rules—our emissions are still growing and our emissions trajectory is still frightening, and these ultimately are the only measures of success or failure that really matter.

It's looking grim because, with declining oil availability, it seems like we'll be facing the climate change challenge in the context of a contracting economy.

It is hard to be positive. It is hard to know what to do and where to put your energy and after eight years working to bring about change, I'm left wondering. And that wondering is what I'd like to offer today.

It begins like this. We talk about climate change as a problem that we need to fix. Which is true, but it's only a half-truth. If we question things further, we find climate change a symptom. It's a side-effect of consumption. And that consumption is, to a great extent, due to the commercialisation of human wellbeing, and an unquestioning faith in our current economic framework.

When we are communicating the climate change issue, we don't dig this deep. We stick to the upper layers, the science, the numbers that we can crunch, the stories of hardship caused by this symptom we call climate change.

Let's consider this for a minute. There is a problem! we say. It is bad and increasingly worse!

Some of us offer solutions. There are alternatives! Biofuels, electric cars! R&D is providing promising results in the lab! Change your light bulbs!

Others say—we can adapt, get used to it, find ways to cope. Adapt the world as we know it? To 4 or 5 degrees? Alternatives? For the rich and the resource endowed? It's my belief that, on their own, these options

offer only partial or short-lived solutions. Young people need us to be investing in strategies that will provide long-term stability, for all. The wondering that I have is: What might happen if we dive a little deeper? If we consider the possibilities we open when we address the root cause of the problem. When we say, what is it that really provides for us and what is it that makes us happy? What do we really value, and are we valuing those things enough? And those things that we value, how can we make them central to our approach and central to our decision making? Is there another way to be?

Collectively, young people need us to have the courage and the foresight to empower our communities to question the assumptions on which we have based decades and decades of human development. The question I'd like to leave you with is: how powerful might that be?

Simon Tegg
Wellington, New Zealand

Constructive discussions about the future and what to do about it are difficult.

Psychologists tell us that we're biased to assume that the future will be much like the past. Our baseline scenario is typically 'business as usual' (BAU) even though BAU is the least likely outcome in the long term. For most Westerners, BAU would be a version of their formative experiences in the remarkably stable, prosperous, and historically anomalous post-war era—an era that now appears to be ending (if you haven't been living under a rock). Pushing beyond BAU, we run into the myths of progress and apocalypse that frame discussions in societies with a Judeo-Christian heritage. John Gray warns that even those of us who purport to be scientifically minded will often simply update the Book of Revelations with the discussant's favourite tropes, be they 'technology', 'changing consciousness', or 'evolution' filling the roles formerly taken by either devils and saviours.

This is not particularly useful. Those who set their sights on grand plans or broad political consensus or some form of BAU, or a revolution in which their ideology triumphs over other ideologies are in for disappointment. The challenge is to set our sights lower than 'saving the world', or even reaching consensus. A couple of working prototypes (and these can be policies, technologies, or designs) that improve things slightly is pretty reasonable and would be most welcome!

...what is it that really provides for us and what is it that makes us happy? What do we really value, and are we valuing those things enough? And those things that we value, how can we make them central to our approach and central to our decision making?



The challenge is to set our sights lower than 'saving the world', or even reaching consensus.



Only in the 1970s did we slowly begin to realise that what we were doing to the Earth was destroying the very basis of our lives.

...two world wars shattered our confidence in the human condition, and we knew how frail and ignorant we were compared with the confidence we had at the beginning of the century.

Ninety years of change

Sir Lloyd Geering³ Theologian, Wellington, New Zealand

I suspect I am the oldest person at the Forum. I was born during the First World War. Because of that, my lifetime has encompassed most of the 20th century. During the 20th century, I witnessed tremendous changes taking place nationally and internationally. At the beginning of the 20th century, humankind looked into the future with tremendous hope and expectation because of developing technologies and science. It was felt that the sky was the limit. Here we were, able to take over the Earth and make something of it. During the century, I witnessed that original enthusiasm and confidence slowly wane. Only in the 1970s did we slowly begin to realise that what we were doing to the Earth was destroying the very basis of our lives.

At the beginning of the 20th century the churches were full. The Christian tradition was so full of confidence that it had a slogan: 'the Christianisation of the world in our generation'. Missionaries were going to every non-Christian place in the world. Gradually over the 20th century I saw the whole missionary process decline and wither and stop altogether. While the churches, full at the beginning of the century, were beginning to empty and today are closing up at a rather rapid rate. At the beginning of the 20th century, the word 'racism' did not exist for the simple reason that we were all racists. It was obvious to everyone that our own race was superior to all other races. Only slowly did we come to appreciate that people who differed from us in race, colour, religion, and culture were perhaps just as good as us.

And so a great change took place globally in the human race. Here in New Zealand we were once proud to be British and part of the British Empire on which the sun never set. And then the British Empire collapsed. Then the Great War and the Second World War made us realise that we sophisticated human beings had yet to learn how to live together. Indeed, these two world wars shattered our confidence in the human condition, and we knew how frail and ignorant we were compared with the confidence we had at the beginning of the century.

³ Sir Lloyd Geering gave this talk at the Café Session.

On the other hand, there were some wonderful things to celebrate during the 20th century. We became aware of racism, which we rejected; we became aware of human rights, which we promoted nationally and internationally; we became aware that women were just as important as men, and the feminist movement had a great success. We are still a bit stuck with homosexuality, but we are winning the day on the sexual front.

At the end of the century, in 1999, I was in Oxford and at a loose end. My late wife was doing a PhD and busy in the library and she said to me, "You had better write a book." So I began to do some research on the future of the world and the next year I published *The World to Come*. As you know, that phrase comes out of the Christian tradition and refers to heaven—but I wasn't referring to heaven. There is no such place. I was referring to the 21st century, the world to come. As I began to study what was happening and projected those trends into the future, I became more and more depressed. For example, during the 20th century the human population quadrupled. Quadrupled! Can you imagine that? Up to 1900, anything humans did by way of interfering with nature had no substantial effect. Nature was still much more powerful and could overcome all that we rather powerless humans could do. But quadruple the human race and it is a different story altogether. Now we were able to destroy the productivity of the Earth. Not only had we more than four times the mouths to feed, but we also had to find a way to produce that food. So we began to tear down the forests and that was the beginning of the problem with carbon dioxide (CO₂) and global warming.

That was only the beginning of the various things that I began to study, so I set out the future of the world to come in 10 scenarios. Not all of them were independent. Two or three or more of these scenarios could eventuate at the same time. Nine of these scenarios were absolutely disastrous. Even I felt that I had to do a bit better than that, so I produced a tenth scenario, in which we muddle our way through, but it is going to be exceedingly difficult. That is why a conference such as this is so important.

Up to 1900, anything humans did by way of interfering with nature had no substantial effect. Nature was still much more powerful and could overcome all that we rather powerless humans could do. But quadruple the human race and it is a different story altogether.

... I set out the future of the world to come in 10 scenarios ... Nine of these scenarios were absolutely disastrous ... so I produced a tenth scenario, in which we muddle our way through, but it is going to be exceedingly difficult.



1 | Climate change and society's challenge



...we keep finding that things are changing faster than was expected or in ways that make the changes more serious.

Climate change introduces a new level of social responsibility because the issues are global and have major long-term implications for future generations.

Risks and consequences, timescales and uncertainties

Professor Martin Manning
New Zealand Climate Change Research Institute
Victoria University of Wellington, New Zealand

Key messages

- Scientists have learned a lot about climate change.
- But science keeps seeing 'surprises' as well—and more risks can become serious.
- We need to remember the 'precautionary principle' that was agreed in 1992.
- This should lead to a collective approach for risk management.

Science has been steadily discovering how and why our climate is changing. But we keep finding that things are changing faster than expected or in ways that make the changes more serious. This has been happening ever since we first realised that burning fossil fuels would lead to a change in our climate, over 100 years ago.

As we force our climate into a new state, it becomes more likely that new and larger surprises will occur. To some extent, governments recognised this in 1992 when they agreed to a 'precautionary principle', which expected that they would have to act to deal with climate change before scientists explained everything in detail. It is now increasingly important to act on that basis.

Much of current policy is based on past experience or focused on the next election. Climate change introduces a new level of social responsibility because the issues are global and have major long-term implications for future generations. Dealing with structural changes of this magnitude requires a very broad social response.

Early surprises for climate science

Much of the CO₂ from burning fossil fuels remains in the atmosphere

In the 1890s, Svante Arrhenius was the first person to calculate how much warming would come from doubling the CO₂ in the atmosphere. His estimates were surprisingly consistent with the latest science, but this advance in our understanding was also a prelude to the first major surprise.

Arrhenius won the Nobel Prize in Chemistry for his analysis of how some chemicals dissolved in water. Because CO_2 is water soluble (and is absorbed by the ocean), he stated that doubling of CO_2 in the atmosphere would take at least a thousand years¹.

Fifty years later, Roger Revelle recognised that the ocean only took up some of the CO_2 going into the atmosphere. The first surprise was that much of it stayed in the atmosphere². Clear evidence for increasing atmospheric CO_2 came from Athol Rafter's radiocarbon dating, showing that carbon in the atmosphere was getting older. Burning fossil fuels³ was the most likely explanation. In 1957, Rafter explicitly discussed major ice sheets melting, significant sea-level rise, and the implications for global warming due to increasing atmospheric CO_2 .⁴

Complex atmospheric chemistry is an important driver of climate change

In the 1970s, scientists discovered that methane was increasing in the atmosphere, raising questions about where it came from and how it was removed⁵. Then, as another surprise, scientists found that methane was a major greenhouse gas (GHG)⁶.

Concentrations of many other GHGs were found to be increasing in the atmosphere and Sherry Rowland and Mario Molina discovered that chloroflourocarbons (CFCs) were starting to destroy the ozone layer⁷. The Montreal Protocol was set up to control these gases for health reasons. However, as they are also very powerful GHGs, the Montreal Protocol has done more to diminish our forcing of the climate system than the Kyoto Protocol.

The next surprise was the appearance of an Antarctic ozone hole. Instruments measuring atmospheric composition in the Antarctic region showed dramatic changes of ozone that scientists initially assumed was due to malfunctioning equipment. In 1985, a paper recognised it was real, which led to a large amount of research showing that ozone loss could happen dramatically⁸.

The removal process for much of the climate forcing due to GHGs is atmospheric oxidation⁹. Scientists still do not have a good understanding of this critical removal process¹⁰ but there is evidence that the removal rate can fluctuate significantly over very wide regions¹¹. Our limited understanding of these changes raises serious risk issues for the future.

The Montreal Protocol has done more to diminish our forcing of the climate system than the Kyoto Protocol.

...the removal rate [of GHGs] can fluctuate significantly over very wide regions.

...keeping to the 2°C target is actually much harder than expected just eight years ago.

Participant comment

Certainties don't exist in climate science. It is down to the best possible management of uncertainties.

The importance of warming relative to the range experienced in the past is that it will challenge our adaptive capacity.

And the surprises are continuing

The best estimate of global warming is more than we thought

In the 1960s, global climate models enabled more detailed analysis of how much warming would be caused by doubling the CO₂ in the atmosphere, referred to as 'climate sensitivity'. Initial estimates were between 2°C and 3.5°C, leading to an early consensus that the value was probably between 1.5°C and 4.5°C¹².

For many years, scientists thought that this meant the most likely amount of warming from a doubling of CO₂ would be about 2.5°C. However, for the fourth Intergovernmental Panel on Climate Change (IPCC) assessment of climate change science in 2007, Susan Solomon emphasised the need to refine the range of estimated values, which led to the finding that the most likely value is actually 3°C¹³. While that might not sound like much of a difference, it means that keeping to the 2°C target is actually much harder than expected just eight years ago. Once again, better scientific understanding led to the problem becoming more serious.

Because New Zealand is surrounded by ocean, climate models estimate that our warming will be less than the global average. However, this can be misleading. The effects caused by climate change will be related to the amount of variability that systems have adapted to. New Zealand has a benign climate in which monthly mean temperatures keep within a range of about 10°C from winter to summer. A mid-range estimate of climate change this century has a warming of 2°C in New Zealand. While that is much less than the warming of about 3°C occurring across much of the Northern Hemisphere, it is larger relative to the winter to summer ranges that we are currently adapted to.

The importance of warming relative to the range experienced in the past is that it will challenge our adaptive capacity. This is seen in a recent study showing that impacts of climate change have already been larger in tropical regions where the seasonal cycle is much smaller than in the mid-latitudes of the Northern Hemisphere¹⁴.

Ice sheets are going and sea-level rise is coming

The last IPCC assessment of climate change science gave estimates for future sea-level rise based on warming oceans leading to expanding sea water plus some melting of glaciers and ice sheets. It also identified that direct observations of increasing ice loss in Greenland and Antarctica were now inconsistent with the climate models. This led to a numeric estimate of sea-level rise this century being up to 0.79 metres, but also a new sense of uncertainties:

“Larger values cannot be excluded, but understanding of these effects is too limited to assess their likelihood or provide a best estimate or an upper bound for sea level rise.”¹⁵

There is growing evidence that ice-sheet loss in Greenland has been accelerating for 20 years, and that this has started to occur in Antarctica. More than a dozen different research groups have produced new estimates for sea-level rise and the median estimate is twice as large as estimates made four years earlier.

New Zealand has a large proportion of its population and investments, as well as key parts of our rail and road transport corridors, on low-lying land. Some of this land has also been reclaimed for our ports, cities, and subdivisions close to the coastline.

Expected sea-level rise now goes far beyond anything in the history of human civilisation and will be more serious because of the trend towards more extreme storm events. Sporadic events may start to cause a breakdown in the viability of current uses in some coastal regions. Scientists estimate that, globally, 100 million people will need to retreat from coastlines by the end of this century, requiring substantial societal relocation¹⁶. There are also growing tensions between those with substantial investments in coastal land and those who accept a responsibility to reduce long-term damages.



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Scientists estimate that, globally, 100 million people will need to retreat from coastlines by the end of this century, requiring substantial societal relocation.

Changes in our climate are already having effects linked across regions larger than single countries.

Impacts of extreme events are becoming so widespread that current meteorological data records cannot track them easily.

Does society have to wait until scientists can explain everything before we take preventive action for increasing risks?

The global dimensions of new risks

Climate change adaptation has been largely based on local measures to deal with the effects, whereas mitigating the amount of future change has been left to the United Nations Framework Convention on Climate Change (UNFCCC). However, a local focus does not cover the full range of impacts. Changes in our climate are already having effects linked across regions larger than single countries.

A recent detailed study of climate models showed that rapid warming in the Arctic will lead to extreme cold events moving southwards into Europe and Russia during a transition period expected to last about 30 years. Such events were described in 2009 and occurred in early 2010¹⁷. Another example of interlinked patterns of change is the increase in heavy precipitation events over much of the Northern Hemisphere, which is significantly larger than climate models predicted.

In 2010, drought in Russia led to widespread fires across regions. This was very unusual and so the resources to respond were limited. A large drop in crop production resulted and the Russian Government banned grain exports. Over the same period, flooding across Pakistan was at record levels, there was serious flooding in China, the upper Amazon River experienced the worst drought on record and its shipping system was closed down for the first time. Impacts of extreme events are becoming so widespread that current meteorological data records cannot track them easily.

Kevin Trenberth has explained such weather events as linked to the Arctic ice-sheet loss and rapid warming in the Indian Ocean¹⁸. However, other possible interpretations have been proposed, challenging our ability to understand the changes.

In 2011, more widespread extreme events have occurred. While the extreme flooding across Queensland in January can be attributed to a strong La Niña, there was again a widespread pattern of such events across Sri Lanka, the Philippines, and Brazil and increasingly serious drought conditions in East Africa and parts of China.

Does society have to wait until scientists can explain everything before we take preventive action for increasing risks?

Society should take over from science when it comes to risk management

In 1996, the IPCC's Summary for Policymakers in the Second Assessment noted the potential for more surprises:

"Future unexpected, large and rapid climate system changes (as have occurred in the past) are, by their nature, difficult to predict. This implies that future climate changes may also involve 'surprises'. In particular, these arise from the nonlinear nature of the climate system. When rapidly forced, nonlinear systems are especially subject to unexpected behaviour."

The precautionary principle

In 1992, governments explicitly addressed the question of whether or not society should wait for scientific explanations of everything before acting. The Rio Declaration adopted the precautionary principle:

"Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

Parts of the private sector involved in risk management appear to be following the precautionary principle. In September 2010, a coalition of over 100 of the top insurance companies formed a new collaborative arrangement with the United Nations Environment Programme Finance Initiative to set up better ways of dealing with increasing risks in developing countries¹⁹. Similarly, the Institutional Investors Group on Climate Change (IIGCC), representing companies that manage \$15 trillion of investment or pension funds²⁰, is addressing more rapid responses to climate change. There is growing recognition of the role of the private sector in providing a large fraction of the capital investment for dealing with climate change.

"Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

Participant comment

Uncertainty is over-marketed. We know more than enough to act now.

Parts of the private sector involved in risk management appear to be following the precautionary principle.

Dealing with such fundamental changes in the small world that we live in takes us into new dimensions and requires a collective social response.

In the longer term, there will be issues that the private sector cannot deal with. There is growing need for structural relocation of a large population because of sea-level rise. The last US Department of Defense Quadrennial Review also linked climate change with significant geopolitical impacts around the world and a need for this to be managed by the armed forces²¹.

Dealing with such fundamental changes in the small world that we live in takes us into new dimensions and requires a collective social response.



Climate futures and choices for society

Professor David Karoly⁴
University of Melbourne, Australia

Key messages

From the Synthesis Report of the Copenhagen Climate conference in March 2009²²:

- Recent observations confirm that, given high rates of observed emissions, the worst-case IPCC scenario trajectories are being realised.
- Recent observations show that societies are highly vulnerable to even modest levels of climate change, with poor nations and communities particularly at risk.
- Rapid, sustained, and effective mitigation based on coordinated global and regional action is required to avoid 'dangerous climate change', regardless of how it is defined.
- Delay in initiating effective mitigation actions significantly increases the long-term social and economic costs of both adaptation and mitigation.

The Garnaut Climate Change Review Update

Very recently, Ross Garnaut was commissioned by the Australian Government to update his 2008 review. His conclusions are²³:

- *"Observations and research outcomes since 2008 have ... strengthened the position ... that the Earth is warming and that human emissions of greenhouse gases are the primary cause."*
- *"Rates of change in most observable responses of the physical and biological environment to global warming lie at or above expectations from the mainstream science."*
- *"Despite the increased scientific understanding of climate change, and confidence in the science's conclusions about climate change, public confidence in the science seems to have weakened somewhat in Australia and some other countries since 2008."*



Recent observations confirm that, given high rates of observed emissions, the worst-case IPCC scenario trajectories are being realised.

Rapid, sustained, and effective mitigation based on coordinated global and regional action is required to avoid 'dangerous climate change' ...

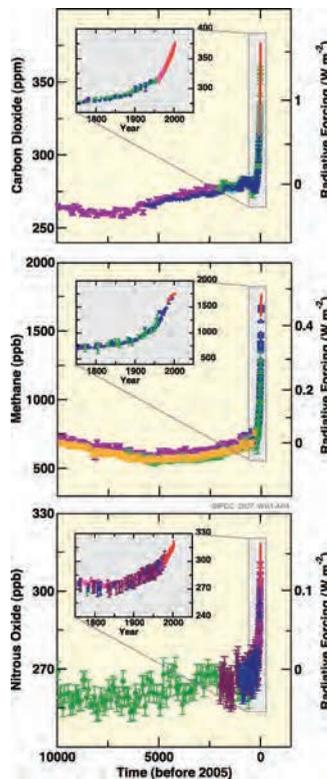
⁴ Ed: This text is based on a transcription of Professor Karoly's Forum presentation.

We now live in the Anthropocene, the first period in geological history in which humankind is having a profound influence on the global climate system.

The Anthropocene

The Holocene is the most recent geological time period, spanning the last 10,000 years. This has been a remarkably stable period in the Earth's history, ideal for the development of human societies. However, in the last 100 years, due to human activity, the rates of change of CO₂ concentrations and temperature have been extremely rapid. We now live in the Anthropocene^{24 25}, the first period in geological history in which humankind is having a profound influence on the global climate system. The choices that we make determine the future climate, not only for ourselves but also for everyone with whom we share the planet and for future generations.

These graphs (Figure 1) from the IPCC 2007 assessment²⁶ show the concentrations of GHGs—CO₂, methane, and nitrous oxide—in the atmosphere over the last 10,000 years.



Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years.

The global increases in carbon dioxide concentration are primarily due to fossil fuel use and land use change, while those of methane and nitrous oxide are primarily due to agriculture.

Figure 1 IPCC graphs of atmospheric GHG concentrations (IPCC Working Group I Summary for Policymakers²⁷)

Climate change impacts

There is plenty of evidence of warming in the oceans, warming in the atmosphere, cooling in the upper atmosphere, retreat of glaciers, retreat of sea ice extent²⁸. We can also look at the patterns of change to show that these increases are not due to natural climate variability. The only pattern that explains observed increases in change is increases in GHGs in the atmosphere due to human activity.

Emissions stay in the atmosphere for thousands of years

There are many natural processes that take up and release CO₂ in the atmosphere and in the Earth system. Even if we switched off emissions now, it would take many thousands of years for the Earth's carbon cycle to remove the CO₂ from the natural systems that humans have added to the atmosphere over the last 100 years. Twenty-first century increases in CO₂ will lead to warming and sea-level rise, not just in 2100 but for more than a millennium. Sea-level rise projections for 2200 or 2300 are 2–5 metres²⁹.

There is plenty of evidence of warming in the oceans, warming in the atmosphere, cooling in the upper atmosphere, retreat of glaciers, retreat of sea ice extent.

Conclusions from IPCC AR4 (2007)

- It is very likely that hot extremes, heat waves, and heavy precipitation events will continue to become more frequent.
- Snow cover is projected to contract. Sea ice is projected to shrink in both the Arctic and Antarctic.
- Storm tracks are projected to move poleward, with changes in wind, precipitation, and temperature patterns.
- Increasing atmospheric CO₂ concentrations will lead to increasing acidification of the ocean.
- 21st century anthropogenic CO₂ emissions will contribute to warming and sea level rise for more than a millennium, due to the long timescales required for removal of this gas.

Figure 2 IPCC main conclusions³⁰

If the Arctic sea ice reduction is being underestimated, many other changes might also be underestimated in the models.

Changes are occurring faster than the models have predicted

As Martin Manning said, the recent science is showing more rapid changes³¹. For example, reduction in summertime minimum Arctic sea ice is occurring faster than any of the climate model simulations used in the 2007 assessments predicted. This is because the complex processes coupling between the oceans, the atmosphere, and the ice in the Arctic are very sensitive and are not sufficiently and reliably represented in the models. This is an important positive feedback. If the Arctic sea ice reduction is being underestimated, many other changes might also be underestimated in the models.

Observed sea-level change over the last 30–40 years, from both tide gauges and satellite data, is at the upper end of the IPCC projections. Recent observations are showing rapid increases in sea level.

In 1997, the Kyoto Protocol was established to try to limit GHG emissions. Yet there has been an increase in CO₂ emissions from burning fossil fuels, so that the rate is now at the upper range of the IPCC projections.

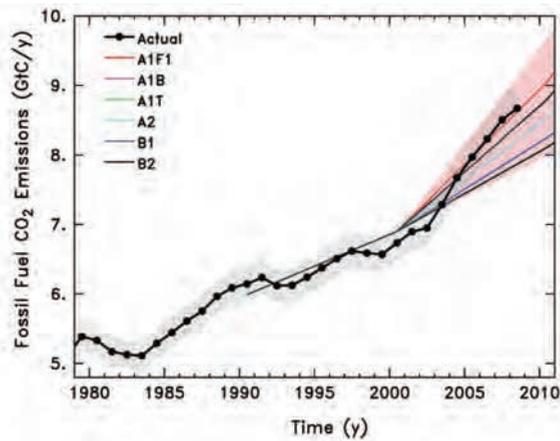


Figure 3 Copenhagen Diagnosis (2009) graph showing actual emissions next to IPCC scenario projected emissions³²

Climate protection on the basis of equity

All countries have signed the UNFCCC, agreeing to stabilise GHGs in the atmosphere at a level that would prevent dangerous human interference with the climate system. At the time that this was written in 1997, no one really knew what ‘dangerous interference with the climate system’ meant. In 2009, under the Copenhagen Climate Accord, countries agreed to limit GHG emissions so that global temperatures would be unlikely to increase more than 2°C above historical levels. Even at this level, there will be widespread adverse impacts, which are greater in developing countries. Adverse effects will also be greater in more vulnerable groups, such as the poor and elderly, not only in developing but also in developed countries.

BAU approach

With BAU emissions, global temperatures increase by up to 6°C by 2100, with many impacts on ecosystems, agriculture, water resources, health, coasts, and society. On this path, global sea level will rise by at least 7 metres over the next few hundred years, displacing at least a billion people³³.

The temperature responses and warming relative to pre-industrial times are shown in Figure 4³⁴. The best estimate for warming is 5°C under BAU, for a global average. This global average is actually the predicted warming for New Zealand under BAU. For many parts of the world, the global average is not relevant, because it is the average of the ocean temperature change and the land temperature change, and the land warms up faster—about 25 percent faster than the global average. Even though this is a global average picture showing warming up to 6° or 7°C, land average warming is up to 25 percent larger than this. And we live on the land, not in the ocean, so this is very significant. We’re talking about warming in inland continental areas, which is 10°C or greater under BAU in 2100, with dramatic consequences.

Carbon-budget approach

To achieve the Copenhagen target of limiting emissions to 2°C above pre-industrial levels, we have to take a carbon-budget approach, which shows that future temperature rise is directly related to cumulative emissions of CO₂³⁵. This approach shows that what matters is not the rate of change but the total sum of CO₂ emissions. It doesn’t matter if we emit it now, or tomorrow, or in five years time. If it is emitted, it will cause warming.

With BAU emissions, global temperatures increase by up to 6°C by 2100, with many impacts on ecosystems, agriculture, water resources, health, coasts, and society.

Participant comment

With a small population of a land-proud people, NZ should be an exceptional ‘laboratory’ for implementing socially driven changes in sustainable living and positive changes in policy to combat climate change ... Why is this not the case?

The budget approach says that the world needs to emit less than one trillion tonnes of CO₂ from fossil fuels into the atmosphere over the period 2000–2050 to retain a risk of only 25 percent of exceeding the Copenhagen target.

Under the carbon-budget approach ... New Zealand has 18 years to get to zero emissions.

The budget approach says that the world needs to emit less than one trillion tonnes of CO₂ from fossil fuels into the atmosphere over the period 2000–2050 to retain a risk of only 25 percent of exceeding the Copenhagen target. Higher emissions give a greater risk of exceeding that target.

This approach would require us to:

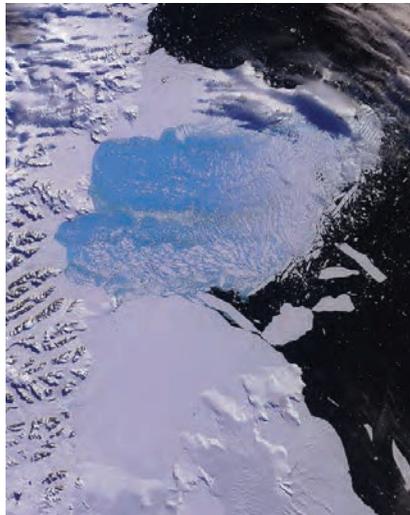
- reduce global emissions by more than 75 percent by 2050
- reduce global emissions by 100 percent by 2080.

This is a zero-carbon world in terms of net CO₂ emissions.

For an equal carbon budget per person, this means an individual budget of about 140 tonnes of CO₂ emissions between 2000 and 2050, or about three tonnes per person per year. This is much much less than typical per capita emissions in developed countries.

Under the carbon-budget approach, Australia needs to go to zero emissions in six years. New Zealand's fossil fuel emissions are much lower than Australia's but they are rapidly growing (46 percent higher than in 1990). New Zealand has 18 years to get to zero emissions.

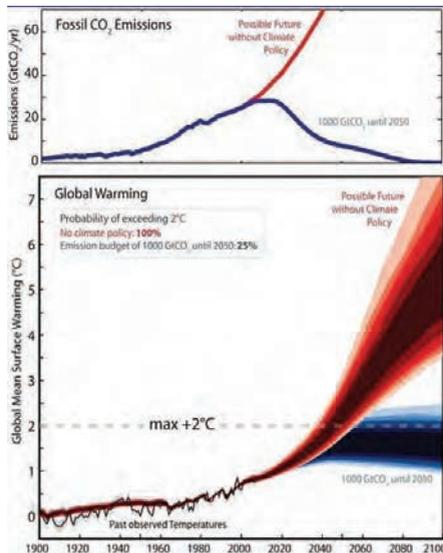
Achieving the Copenhagen target therefore requires rapid, sustained, and substantial reductions in GHG emissions, particularly in developed countries.



Larson B ice shelf collapse 2002, NASA. The image represents an area of approximately 149km x 186km.

This alternative path involves a rapid transition to a low-carbon economy, with significant but much reduced impacts from climate change. There are many opportunities from this transition, but there are also many difficulties. The technologies needed to power a low-carbon economy already exist, but at present it appears that the political will does not. If I was driving a car and being told that I had a 25 percent chance of driving off a cliff, I'd be changing direction sooner. Waiting is not doing nothing. Waiting is making a conscious decision that you want climate change to get worse because you are not reducing your emissions. Every year that we don't act is a commitment to further climate change for the next millennium.

The technologies needed to power a low-carbon economy already exist, but at present it appears that the political will does not.



Budget approach

Cumulative emissions allowed for 25% risk of exceeding 2°C

- Equal per capita emissions allowance
- Global budget of 1000Gt CO₂ until 2050
- For world population of 7G, 140 t CO₂ per capita budget until 2050
- For NZ, emissions of 8t CO₂ per person from fossil fuels, budget is used in less than 18 years.

Figure 4 Carbon-budget approach from The Australian Academy of Science (2010)³⁶, adapted from Meinshausen et al. (2009)³⁷



We need to remember that New Zealand's gas emissions in the electricity, transport, and agricultural sectors have increased significantly since the 1990 assessment of the impacts of climate change.

Crafting the long view

Sir Paul Reeves
Former New Zealand Governor-General

Emissions targets

New Zealand's targets

In September 2008, the Labour Government passed into law the New Zealand Emissions Trading Scheme (ETS), which aimed to move the cost of emissions onto those who cause them. The incoming National Government pushed back the extension of the Scheme to agriculture to 2015 with Nick Smith saying agriculture will not be included "unless there are practical technologies farmers can employ to reduce their emissions". On the other hand, Labour's climate change spokesperson Charles Chauvel said agriculture needs to come into the scheme no later than 2015 "otherwise the message to the biggest emitting sector is that they can just continue as they are because there is going to be no discipline"³⁸.

A recent Minister's position paper put out for consultation says our proposed long-term emissions reduction target is a 50 percent reduction in New Zealand's GHG emissions from 1990 levels by 2050, or in short 50 by 50. That is a controversial target. We need to remember that New Zealand's gas emissions in the electricity, transport, and agricultural sectors have increased significantly since the 1990 assessment of the impacts of climate change. I am encouraged by what the Minister has said about constant review, pace, and detail.

The Kyoto Protocol

Nick Smith thinks the panel set up to review the ETS may recommend that New Zealand should not take the next step until there is international acceptance. Probably that won't happen for a long time. It's not clear that the Kyoto Protocol will survive beyond 2012. Japan, Russia, and Canada are not interested if the United States stands aside. Emerging nations like China say economic development is their priority and any restraint on emissions will have to recognise that.

If international politics are unsettled and protective of national interests, then we should not be surprised if our own politics are bound to display similar dynamics. The politics are complicated and I'm sure that even within our present government there are interests that remain to be convinced. The tension between sectional interest and the quest for national interest is at the heart of the political process. The Minister's position paper talks of achieving the balance between the desired reductions in GHGs and the impact on the economy and our lifestyle. It's a political debate that is beginning to heat up.

Climate change impacts for New Zealand

Migration from vulnerable Pacific Islands

Some of our near neighbours are small island states with small land areas, a high population density, a limited range of natural resources, a fragile resource base, a narrow range of skills, and low economic resilience. Fifty percent of the people in the Pacific Islands live close to the coast. The South Pacific Commission predicts that climate change could halve the coastal fisheries catches that support these communities. Many of these islands are no more than 3 or 4 metres above present mean sea level. A change of temperature and an intensification of rainfall could mean the spread of malaria, dengue fever, and water-borne diseases. Coastal land loss and beach erosion, such as we saw recently in Samoa, will intensify the displacement of communities.

Already Tuvalu and Kiribati are in trouble and their future uncertain. People from here already travel to Australia, New Zealand, the United States, and elsewhere in the Pacific and relocation is something they could manage. Constitutionally, Niue, Samoa, the Cooks, and Tokelau have guaranteed access to New Zealand in one form or another.

Climate change could significantly accelerate the movement of people to New Zealand and most of them would be headed towards South Auckland or Porirua, perhaps to join communities already established there. There are already more Niueans in New Zealand than in Niue. The survival of Niuean language and culture is going to be decided in New Zealand, not in the homeland.

It's not clear that the Kyoto Protocol will survive beyond 2012.

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...if emissions are a sign of affluence then it must be said that affluence creates poverty and inequality.

We can expect that immigrant groups will want to retain their own cultural practices and lifestyles and be treated as full members of society.

Migrants with limited English are disadvantaged at work and their earning power is restricted. Seventy percent of Aucklanders with very low literacy are Pasifika or Asian. There are people in the workplace and who are not working to their full potential because they need preventive medical care and targeted literacy programmes. And if emissions are a sign of affluence then it must be said that affluence creates poverty and inequality.

We can expect that immigrant groups will want to retain their own cultural practices and lifestyles and be treated as full members of society. Identity is always about the exercise of the power to include and exclude. Inevitably, this means they will have to work out their relationship to the predominant cultural identity of their new country. It's not easy but what I observe are second and subsequent generations of immigrants who are skilled in managing multiple identities.

Māori are particularly vulnerable to climate change

Māori are a vulnerable group who suffer during economic recession. Unemployment rates are already high and participation in higher-paying occupations is relatively low. Changes in regional employment and increased prices of assorted food stuffs due to climate change would have a large impact on Māori. Already many Māori in Papakura and Manukau are likely to be NEET (not in education, employment, or training) and most at risk of poor labour outcomes.

The coastal environment is a very important food source for Māori and coastal erosion and flooding would have severe social, cultural, and economic impacts. The exposure of urupā and sensitive wāhi tapu sites would be a high possibility. Many Māori communities are in rural areas that would be prone to new diseases, such as the Ross River virus and dengue fever. One should anticipate that Māori will lodge claims before the Waitangi Tribunal if resources are threatened.

Society's challenge

The 'she'll-be-right' mentality

The plural nature of our society means that we don't speak with a single voice—we never did—but we do need to be connected. Climate change throws up attitudes and assumptions we make about ourselves, how we see ourselves, and how we deal with issues. We are not introspective people. If anything, we pride ourselves on being adaptable; more practical than cultured. We claim that we can generate wealth through the creation and manipulation of new materials whether it be the ingenious use of flax, the proverbial number eight fencing wire, or the clever use of our geothermal resources. If we have to, we can make do with less and still come up with a good result. There is an inherent incremental pragmatism. Big issues are tackled bit by bit.

This is a view severely criticised by Fran O'Sullivan in the wake of the Pike River and Christchurch disasters. She asks how much did this she'll-be-right attitude play in the decision by the under-capitalised Pike River mining company to build a mine with few escape routes? "The consequences of repetitive disasters that might have been anticipated by more sophisticated standards is national bankruptcy."³⁹

Here is another variant on the do-it-yourself theme, but slightly out of left field. Some claim Wellington's Futuna Chapel in Karori is our finest piece of architecture. It was designed by the Māori architect, John Scott and the team chosen to construct it was six Marist brothers led by Brother Joseph Kelly. None of them had any building qualifications. Everything was done by hand and their only tool was a half inch drill. They had a small concrete mixer and two wheelbarrows but no crane. Large roofing beams were hauled into place using a block and tackle. A lack of



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One should anticipate that Māori will lodge claims before the Waitangi Tribunal if resources are threatened.

The plural nature of our society means that we don't speak with a single voice—we never did—but we do need to be connected.

Participant comment

People always have and will continue to look to churches for leadership. For the churches not to have a position and not to be out there leading on climate change (as they were in 1981 expressing opposition to apartheid and the tour) is to endorse non-action on climate change and the continued growth of greenhouse gas emissions.

...scientists don't just collect facts. They relate them to each other and place them within a wider imaginative picture. You can't isolate science from the rest of life. All of our thought, including science, arises out of imagination.

experience and tools never slowed things down. Brother Joseph says they simply learnt how to do things or found another way. During the entire construction the only tradesmen used were an electrician and a plumber.

Science and religion

The Brothers who built the Chapel did not see it as an expression of the Kiwi do-it-yourself attitude that keeps stores like Mitre 10 and Hammer Hardware going. They saw it as expressing their faith in God. That seems strangely out of step in a society where religion no longer dominates the structures that shape our world and our leaders routinely assure people of their thoughts, but rarely their prayers. If theology is to speak about God, and if by definition God is not available for inspection as an object in a laboratory, that means speaking about the imprint of God on human lives. That's how the builders of Futuna Chapel would expect you to assess their work.

I am influenced here by the philosopher Mary Midgley, especially her book *Utopias, Dolphins and Computers: Problems of Philosophical Plumbing*⁴⁰. The difficulty, she says, is that religion and science are seen as competitors, alternative attitudes belonging to separate tribes—one childish, the other mature. Science seems to mean honest acceptance of the facts as opposed to religion, which licenses childish wish fulfilment. But scientists don't just collect facts. They relate them to each other and place them within a wider imaginative picture. You can't isolate science from the rest of life. All of our thought, including science, arises out of imagination.



An interesting point of intersection is the Gaia theory advanced by James Lovelock. It has both a scientific and a religious aspect. Lovelock is not saying the Earth is conscious and capable of forming purposes. Rather, life is not a loose and chance jumble of competing entities. Life is an interdependent system that keeps itself going by a constant interchange of benefits between its parts. That's why the system is vulnerable and at risk. That's why the stakes are so high over climate change.

Society is enriched through diversity and honesty

I am the chancellor of the Auckland University of Technology (AUT), New Zealand's youngest university. Our central city campus is crowded with a lot of building going on but the place really comes alive when the students are back. We get flooded with chattering, vibrant young people with different cultural traditions, religious loyalties, and ethnic identities.

AUT's question is really the nation's question: How can all these exist together in a climate of mutual and honest questioning? How can our differences enrich each other? So at AUT we seek to be a community of human beings engaged in learning. To be alive is to learn, so learning is a life-long process. Our invitation to the students is: Where better could you start than with us as we seek to be a secure space, an open society, where other voices are welcome and listened to? We don't claim perfection but we do ask for honesty. We hope to learn from our mistakes.

To quote Karl Popper: Totalitarian regimes lay claim to ultimate truth and impose their views by the imposition of force, but nobody has access to the ultimate truth. A perfect society is unattainable. We must content ourselves with an imperfect society that is, however, capable of infinite improvement. That is an open society.

I would submit, ladies and gentlemen, that we have much to learn about nation building and the challenge of an open society in the way we approach the pressing urgency of climate change.

Physical matter is not inert stuff, foreign to life. It is a mighty organised whole of which we are a part. We belong here and we belong within a whole that we need to take seriously. Our thinking about climate change needs to be wide and expansive.

Life is an interdependent system that keeps itself going by a constant interchange of benefits between its parts. That's why the system is vulnerable and at risk.

How can all these [different cultural traditions, religious loyalties, and ethnic identities] exist together in a climate of mutual and honest questioning? How can our differences enrich each other?

A perfect society is unattainable. We must content ourselves with an imperfect society that is, however, capable of infinite improvement.

Governments tend to respond too slowly to crises, because of slow change in electoral awareness, and an unwillingness to get out ahead of other countries to their own apparent disadvantage.

Participant comments

How do we change politics to emphasise continuity and the long view?

Lack of public understanding, even public interest, is the biggest problem.

Salient and observable action is essential when addressing problems with long timeframes.

Group dialogue session

Rapporteurs (Ralph Chapman, Judy Lawrence, Amanda Wolf)

Building public awareness in the face of rapid change

Encourage collective action

We have science, events, actions, and somehow a sense that these are not quite enough. We are in a world with people at loggerheads. What can we do when being at loggerheads won't do?

Beyond science and individual action there is something more to be had—a collective response to the collective, societal risk we face. It is about incremental action and building on a wide range of existing actions and opportunities. We need to find opportunities for communicating across the range of interests.

Use the education system

In New Zealand, there is still a lack of awareness of the huge risks of climate change. Scientists have difficulty communicating uncertainty. Governments tend to respond too slowly to crises, because of slow changes in electoral awareness, and an unwillingness to get out ahead of other countries to their own apparent disadvantage. (However, slow movers are punished in the long run.)

How do we bridge the gap between what scientists know and what the public know? In general, we cannot expect the media to inform people well—they are too sensationalist and commercial. One option is using the education system—teaching children is a good way to teach parents. We need to work on people's understanding of complex systems, in various ways. Education for Sustainability was a good initiative for building public awareness and similar programmes could be fostered.

Reward action

There is the challenge of spreading and rewarding green action and activism. New Zealand has the big advantage of allowing and fostering a lot of interaction from diverse perspectives. Often the best way to get involved is around an event. The Australian Youth Climate Commission (AYCC) seems to have been effective, often focusing on events. They have >60,000 members (under 25s), which is more than any political party. Salient and observable action is essential when addressing problems with long timeframes.

Carbon dioxide versus methane

We explored a technical issue about why David Karoly had framed his comments around CO₂ only and had not included methane. David explained that CO₂ has a very long lifetime in the atmosphere so the effect endures over generations; compared with methane, which degrades to CO₂ over a shorter timeframe, despite its greater short-term warming effect. David acknowledged that there was a role for early reductions from methane that would make a difference to reducing overall emissions.

Low-carbon growth

Debate the growth paradigm

The growth paradigm needs much more debate among society at large—even though the limitations and problems with growth are well known among those informed on the issue. We do have the technical ability to decouple economic growth from carbon emissions, but in practice it is difficult under present institutional arrangements and market systems.

Do benefit-cost analyses

The Stern Review in the UK and the Garnaut Review in Australia have great value and show that reductions in carbon can be made at costs that can be managed. However, New Zealand has yet to undertake such a comprehensive independent review of carbon reduction policies and the costs of what is possible here.

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Different adaptation approaches will be needed in different places, as adaptive capacity and societal resilience will differ across the country ...

...planning and political cycles are conspiring towards the short term and affecting resilience in the long term.

The market is telling a very different story from the democratic political system. Not only is the timeframe different, but so is the manner in which the market creates a collective, coordinated 'being' different from that of the political system: we can learn from that.

Do regional vulnerability assessments to inform adaptation plans

We need to understand the nature of the climate change risks across the country and identify critical exposure to those risks. Different adaptation approaches will be needed in different places, as adaptive capacity and societal resilience will vary across the country, depending on the vulnerability of the regions.

The planning and political cycles are conspiring towards the short term and affecting resilience in the long term. Greater government focus on adaptive capacity will be necessary to avert high community costs. Governments and consumers need to take responsibility for emissions liabilities.

Encourage more community-based adaptation

There is a huge sense of frustration with the top-down UNFCCC process. Most of the action that is occurring is now bottom up. In Australia, there are some positive developments such as the Hepburn Wind Project Co-op. It's a good example of a community-owned wind project—and the Co-op is making the planning and action template available free as a model for other communities.

Creating a healthy society

Maintain social connectedness

It feels like the future is spinning out of control. Connecting through social media across the world could be a way of gaining control. Social connectedness is an important driver of security and fostering the common good. Insecurity can make people less compassionate. However, our security as a society should not be at the expense of compromised compassion.

Address the full social costs

It seems that the ETS response to climate change is dealing with costs at the margins, while the full social costs, especially to future generations, are not being addressed.

Maintain cultural health

We need to pay attention to the cultural health of groups of people who may be displaced by climate change. Tensions may arise as displaced people arrive into pre-existing cultures and conditions.

Seek a common vision

We need to seek a unified vision of the future, with much more community dialogue about what we can do. For example, carbon zero is possible for electricity across New Zealand but resources are needed to do it. More dialogue with young people is needed. Older generations need to get out of their established positions and work toward the common good across generations. We can learn from long-lasting civilisations and from history.

Use creativity and imagination

We need creativity and imagination. People respond better to creativity and humour than to messages of fear and guilt. Imagination requires faith—the everyday faith that allows us to look into an uncertain future and a faith that somehow we'll get through the bad times and come out the other side. A sense of the awareness of our interconnectedness sparks imagination and sensitivity to the failures of imagination.



Participant comment

Can we learn from examples internationally where countries have had to change in response to major threats (eg Denmark—oil shock in 1970s, Cuba—collapse of Soviet Union)? In such examples, might we not find some clues about how to manage change and behavioural changes?

We need to seek a unified vision of the future, with much more community dialogue about what we can do.

Participant comment

'Science' peddling fear and diabolical consequences is not working. Social and psychological scientists know this and they know why. I hope we will hear from them. Fear is not an appealing emotional response.

Responding to scientific uncertainty: The reinsurance industry's perspective

Martin Kreft¹
Munich Re New Zealand



When it comes to climate change, overall risk awareness has to change. One area that particularly needs to be addressed is that society needs to take over from scientists when it comes to risk management. Most of society is currently reluctant to consider risk and not inclined to address adverse outcomes.

Munich Re is seeing a clear rise in weather-related catastrophes. Different ways of mitigating and adapting to them are necessary. In the long term it is possible to foresee a world where these changes produce areas that are subject to inevitable damage and unable to be offered affordable insurance protection. This means society will not have the protections currently enjoyed or will have to pay a higher price for them. We need to find ways of raising risk awareness and preparing for the changing conditions ahead to build up resilience for our communities.

How does society cope?

There will be more events that demonstrate action is needed. We can already see that weather-related catastrophes worldwide have tripled over the last 30 years, partly due to climate change. The recent earthquakes in Christchurch also show that actions are necessary because we are going to end up with authorities saying that land in some parts of Christchurch has little value. This has significant implications for local governments, citizens, and businesses.

Whilst this is as a consequence of earthquakes, there are also direct implications here for the consequences of climate change, if large areas of coastal land become uninhabitable.

There will also be changes in the way the economic system operates and insurance is one of them. The rise in weather-related catastrophes means that people eventually have to pay for them, either through higher prices for insurance or through taxes governments may use for repair costs.

How does the reinsurance industry respond?

Munich Re has over 30 scientists and researchers assessing natural catastrophe and climate change risk. We have the world's largest database on natural catastrophes. This gives us clear guidance for our risk management, regardless of whether this change is fully attributable to climate change or not. It helps our experienced underwriters to determine risk-adequate prices for the insurance cover we offer.

Fixed timeframes are hard to reconcile for things that are uncertain. This is why Munich Re puts great effort into projections using scenarios, which drive our risk management. We continuously monitor risks worldwide, including global peak risk scenarios, more than half of which are weather related. A Wellington earthquake is also one of these scenarios. They regulate our behaviour on what are acceptable risks in these areas.

1 Martin Kreft gave this talk at the Breakfast Session.

In some regions, the changes in weather-related catastrophes are driving the industry to put more focus on non-peak scenarios, because these are becoming more frequent. Australia, for example, has had a number of weather-related events in the last 12–18 months, which are eroding insurers' allowances for large claims.

Worldwide, 2011 is already the year with the highest-ever economic losses recorded for the reinsurance industry, with US\$265bn up to the end of June. This easily exceeds the total figure for 2005, previously the costliest year to date with US\$220bn.

How many big hits can the industry cope with?

Due to strict risk management, Munich Re has been able to absorb the exceptional large losses of the recent natural catastrophes.

However, these catastrophes show that risk-adequate insurance prices are necessary throughout the cycle (years with a large number of claims and years with a low number of claims).

For the industry, the large earthquakes in New Zealand and Japan have mostly been profit eroding. If there were more big events to come in close succession then they could become capital eroding and will likely cause significant reassessment of reinsurance risk appetite.

Reinsurers generally adapt very quickly, as they have a large amount of capital at stake. Munich Re has developed many products, also in cooperation with governments, to achieve wider insurance coverage against natural disasters. We see the urgent need for more protection against natural catastrophes, especially in the Asia Pacific region.

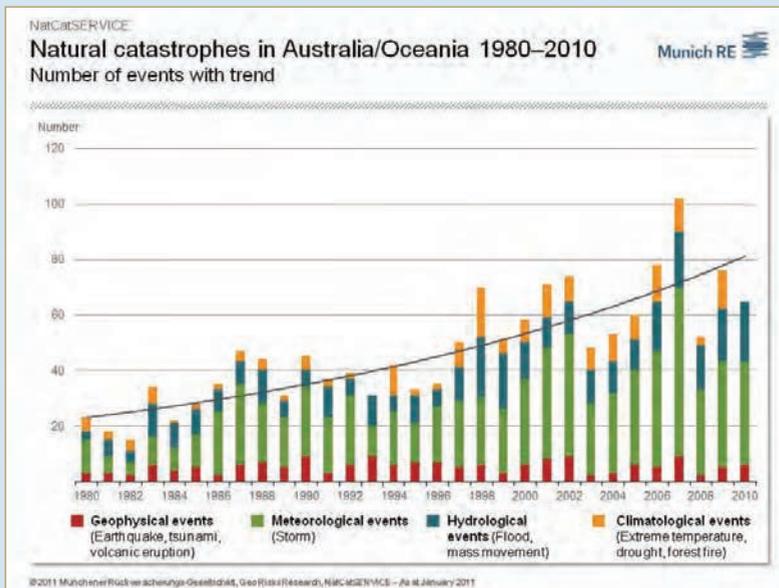


Figure 5 Munich Re graph showing the trend in increasing natural catastrophes



2 | Communication between the science community and society



...there has been an organised effort to cast doubt on the existence of anthropogenic climate change in the United States.

Communicating the science of climate change: Lessons from history

Dr Erik Conway

Historian of science and technology, United States

An organised effort to cast doubt

For the last few decades there has been an organised effort to cast doubt on the existence of anthropogenic climate change in the United States⁴¹. Today, a Chicago-based political ‘think tank’, the Heartland Institute, seems to be the most visible face of this effort. But the effort is older than the Heartland Institute. Its origins are in a different ‘think tank’, founded by scientists, in Washington, DC. Called the George C. Marshall Institute, it was founded by three physicists who felt a burning need to defend President Ronald Reagan’s Strategic Defense Initiative (SDI) from other physicists.

The Strategic Defense Initiative

SDI was a programme to develop a large-scale, space-based anti-ballistic missile system during the 1980s. It was a locus of conflict within the American physics community, with individuals cleaving along a line between supporters of arms control and supporters of weaponising. The Union of Concerned Scientists, aided by astronomer Carl Sagan and nuclear physicist Hans Bethe, led the effort to remove funding from SDI. In 1984, astrophysicist Robert Jastrow invited solid-state physicist Frederick Seitz, and nuclear physicist William Nierenberg, to join him in forming a conservative counterweight to the Union of Concerned Scientists. They were briefly joined by geophysicist S. Fred Singer, who soon went off to found his own ‘think tank’, the Science and Environmental Policy Project.

The Marshall Institute

The Marshall Institute spent its first five years contesting claims that SDI wouldn’t work, and that it was destabilising international order. It also worked to paint a dire picture of Soviet strength and American weakness. One 1987 Jastrow article was titled ‘America Has Five Years Left!’⁴² The disintegration of the Soviet Union left the Institute in need of a new mission. Challenging the reality of anthropogenic global warming became that new mission.

In 1989, Nierenberg briefed the George H. W. Bush White House that global warming was probably caused by the Sun, and, that as solar irradiance declined in the 2000s, would come to an end on its own. As evidence grew throughout the 1990s that this view was wrong, the Institute expanded its attacks on mainstream climate science and climate scientists. In 2007, with its founders retired or deceased, it was simultaneously acknowledging that uncertainties in climate science were not a basis for policy inaction and promoting the hoax narrative—that “the widely propagated ‘fact’ that humans are contributing to global warming is the ‘greatest deception in the history of science’”⁴³.

A defence of free-market capitalism

Why did these physicists take up a retirement career in spreading doubt about anthropogenic global warming? The evidence, from their own words, suggests that their principal concern was not the quality of the science, but with the defence of market capitalism from environmental ‘extremists’⁴⁴. In one example, Singer wrote that global warming was being hyped based on a “hidden political agenda” against “business, the free market, and the capitalistic system”⁴⁵. In this view, these ‘extremists’, scientists included, were merely socialists in green makeup. Recall that the Cold War these physicists had invested their lives in, was fundamentally a conflict between duelling political ideologies: capitalism versus communism. From these claims, Oreskes and I draw the conclusion that science had nothing to do with the denial of global warming. The rejection of science, instead, was the result of political beliefs. These Cold War physicists were market fundamentalists, and could not accept the physical evidence of market failure.

Market failure

Anthropogenic global warming is, in the words of Nicholas Stern, former chief economist of the World Bank, “the greatest and widest-ranging market failure ever seen”⁴⁶. Fixing it requires some form of market intervention by government, the very thing these gentlemen feared. It’s important to understand the resistance to climate science is really about ethics and values: How best to organise society? What roles should business and industry play in our economies? What responsibilities do we have to the future? The denial of global warming is, in the end, the result of political beliefs, not the failings of science.

The rejection of science, instead, was the result of political beliefs. These Cold War physicists were market fundamentalists, and could not accept the physical evidence of market failure.

Anthropogenic global warming is ... “the greatest and widest-ranging market failure ever seen”.

...resistance to climate science is really about ethics and values: How best to organise society? What roles should business and industry play in our economies? What responsibilities do we have to the future? The denial of global warming is, in the end, the result of political beliefs, not the failings of science.

We think scientists should be upfront about their ethics and values ...

There's little point in claiming neutrality when no one believes that anyway.

Participant comment

Communication is critical but it needs to be targeted and strategic.

The best science journalists weave context into their writing about new findings and, because science journalism is rapidly waning, scientists should learn to do the same.

Better science communication

Providing information alone is inadequate

There has been much recent discussion of how to better communicate climate science to the public. Many scientists practise the 'deficit model' of science communication: if we only provide more and better facts about X, the public will believe X. Empirical evidence suggests this is wrong. Most people, even some scientists, accept or reject claims on the basis of their pre-existing beliefs—political, economic, and religious⁴⁷. And they evaluate claims based on their perception of the beliefs of the person making those claims as well⁴⁸. The Marshall Institute and its allies have been extremely successful in painting climate scientists as elitists, if not socialists and communists; among conservatives in the United States, this view has become nearly universal. Thus the totality of climate science can be dismissed as a giant political hoax.

Be upfront about values

If communication is not value-free on either end of the conversation, what should scientists do? We think scientists should be upfront about their ethics and values. The late Stephen Schneider argued that this resulted in better science, not just better science communication⁴⁹. They also need to address Americans' fears that anthropogenic climate change is merely socialism in green makeup. There's little point in claiming neutrality when no one believes that anyway.

Tell stories

As others have suggested, scientists should learn to turn their work into a story⁵⁰. While charts and graphs are part of the stuff of science, few non-scientists understand them. The best science journalists weave context into their writing about new findings and, because science journalism is rapidly waning, scientists should learn to do the same. Increasingly, they must learn to tell their own stories.

Explaining complexity: Challenges for the Fourth Estate

Fred Pearce

Author and environmental journalist, United Kingdom

The media and complexity

We in the media like our stories simple. We like good guys and bad guys and that X marks the spot where the disaster happened. We like sex and violence. The attention span of the average reader or viewer—and the average news editor—is very short. There is an old adage in advertising that you have to sell the product in a six-word slogan. Journalism isn't very different. If you can't write the headline, the story is probably too complicated.

Conveying complexity or nuance is extremely difficult. Conveying ideas like uncertainty and error bars is even harder.

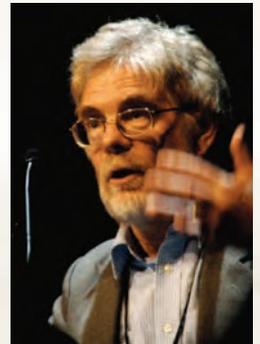
You might think things were easier in science journalism, but in some ways they are less easy. This is because of society's view of scientists. We like to see them as the founts of wisdom. They are supposed to know the truth denied to the rest of us. They are expected to trade in certainties and 'facts'. This myth about the omnipotence of science is one in which many scientists collude, sometimes with disastrous consequences.

What we know

Many people, including some journalists, think that either everything the climate scientists say and predict is true, or it is all lies. That if any part of the narrative is undermined then the whole edifice falls. The truth is more nuanced than that. So what do we know, and what don't we know?

We know GHGs like CO₂ and methane warm the planet. The gases trap solar heat at certain wavelengths and warm the atmosphere. This is 200-year-old physics. To deny it really is to be a flat-Earther.

We know, too, that CO₂ in particular is accumulating in the atmosphere. This is certainly thanks to human emissions from burning carbon-based fuels such as coal and oil. We have direct measurements of that accumulation for more than 50 years. Physicists calculate that for every square metre of the Earth's surface, 1.6 watts more energy enters the atmosphere than leaves it.



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GHGs...trap solar heat at certain wavelengths and warm the atmosphere. This is 200-year-old physics. To deny it really is to be a flat-Earther.

If anything, solar influences would have been cooling the planet in the last half century—the opposite of what has been happening.

...warming causes Arctic ice to melt, which exposes dark ocean water, which reflects much less solar heat into space than the ice it replaces—hence more warming. These positive feedbacks are much less certain than the initial warming.

We know the world is warming. Thousands of thermometers in areas remote from any conceivable local influences tell us that. The oceans are warming too. The great majority of the world's glaciers are retreating, Arctic sea ice is disappearing, sea levels are rising ever faster, trees are climbing up hillsides, and permafrost is melting.

This doesn't prove GHGs are doing the warming. There is a lot of natural variability out there, but not much of it operates globally. If anything, solar influences would have been cooling the planet in the last half century—the opposite of what has been happening. Put simply, it would be very surprising if the cause of the recent warming trend were not GHGs.

What we don't know

How fast or how far will things warm?

We don't know how fast or how far things will warm. The actual warming caused by CO₂ is quite modest—about one degree for a doubling of CO₂ concentrations in the atmosphere. The rest—twice or three times as much according to most climate models—comes from amplifying effects.

For instance, warming causes Arctic ice to melt, which exposes dark ocean water, which reflects much less solar heat into space than the ice it replaces—hence more warming. These positive feedbacks are much less certain than the initial warming.

What happens to clouds?

Clouds have always been recognised as a ticking time bomb in climate models, because nobody can work out whether warming will change them in a way that amplifies or moderates warming—still less how much.

How big is natural variability?

If you can say that, for instance, the world is warmer than it has been for a thousand years or more, thanks to climate change, people take notice. One of the failures of climate science in the past decade has been to have an honest debate about the reliability of data showing natural variability, and what it means. This is an area where the debate has become politicised.

More knowledge, less certainty?

I think I can predict right now the headlines that will follow publication of the next report from the IPCC, due in 2013. They will be something like: "Climate scientists back off predicting rate of warming: 'The more we know the less we can be sure of,' says UN panel."

That is almost bound to be the drift if two-time IPCC lead author Kevin Trenberth and others are right about what is happening to a new generation of climate models. I also confidently predict the IPCC will get an extremely rough ride from the media and elsewhere for admitting its uncertainty. People will say: What use are you if after more than 20 years you know less than you did before? Why do I say this? Last year, New Zealander Trenberth, who is head of climate analysis at the US's National Center for Atmospheric Research, wrote a commentary in the science journal *Nature* headlined 'More Knowledge, Less Certainty'. It warned that the uncertainty in the next IPCC report's predictions "will be much greater than in previous reports". He added that "this could present a major problem for public understanding of climate change".

This plays out most obviously in the critical estimate of how much warming is likely between 1990, the baseline year for most IPCC work, and 2100. The range of warming predicted in the next IPCC reports will be wider, especially at the top end. Some preliminary computer runs have suggested potential warming of 10°C or more.

Trenberth explained: "*While our knowledge of certain factors [responsible for climate change] does increase, so does our understanding of factors we previously did not account for or even recognize.*"⁵¹

It is going to be hard to explain why, when you put more and better information into climate models, they do not home in on a more precise answer. Also, it sounds dangerously like what Donald Rumsfeld, in the midst of the chaos of the Iraq War, famously called 'unknown unknowns'. I would guess that the IPCC will have even less luck than he did in explaining what it means by this.

...the IPCC will get an extremely rough ride from the media and elsewhere for admitting its uncertainty.

Some preliminary computer runs have suggested potential warming of 10°C or more.

"While our knowledge of certain factors [responsible for climate change] does increase, so does our understanding of factors we previously did not account for or even recognize."

All scientific assessments have to grapple with how to present uncertainties.

Participant comment

I am worried about the undue emphasis placed on scrutinising the science while neglecting to scrutinise misunderstood criticisms of peer-reviewed science. No review process is fool-proof; however the IPCC review process might well be the most rigorous method currently in operation today ... are we necessarily being diverted from priorities of higher order?

Scientific consensus

All scientific assessments have to grapple with how to present uncertainties. The IPCC is caught in a particular dilemma because its founding purpose was to reach consensus on climate science and report back to the world. It has always been under pressure to try to find consensus even where none exists. Critics argue that has sometimes compromised its assessments of uncertainty.

While we are discussing how the media conveys uncertainty, perhaps the bigger issue is how scientists cope with it themselves, especially in their dealings with the outside world. I am far from alone in that view. When the work of the embattled IPCC was reviewed by a United Nations (UN) panel last summer⁵², the conclusion of the panel's chairman, Harold Shapiro of Princeton, was that existing IPCC guidelines on presenting uncertainty "have not been consistently followed". In particular, he said, its analysis of the likely impacts of climate change "contains many statements that were assigned high confidence but for which there is little evidence".

The claim that the Himalayan glaciers could all have melted by 2035 was a crass error resulting from cutting-and-pasting a claim from a report by a non-governmental organisation. But there were other failures. A headline claim, in the report's chapter on Africa, was that "projected reductions in [crop] yield in some countries could be as much as 50 percent by 2020". But the forensic trail on that claim, which I pursued for *New Scientist* magazine, was equally dodgy. The cited source was an 11-page paper by a Moroccan researcher. It covered only three of Africa's 53 countries (Morocco, Tunisia, and Algeria), had not gone through peer review, contained no original research, and did not cite any. It simply asserted that "studies on the future of vital agriculture in the region have shown ... deficient yields from rain-based agriculture of up to 50 percent during the 2000–2020 period".

Even its author did not claim the changes were necessarily caused by climate change. In fact, harvests in North Africa already differ by 50 percent or more from one year to the next, depending on rainfall. In other words, it said nothing at all about how climate change might or might not change farm yields across Africa. None of this was conveyed by the IPCC report, even in the footnotes.

'Climategate'

This, then, is not just about the communication of science to the public. It is about the conduct of scientists and how they respond to the expectations of society about science and its conduct. The media often amplify that, of course. And that happened in the furore over what came to be known as 'Climategate'. The release—hacking or leaking, we don't know—of more than a thousand emails sent and received over 14 years by researchers at the Climatic Research Unit at the University of East Anglia (UEA) in England.

In the resulting row, media commentators mostly took one of two views: either that the emails revealed nothing of importance and were stolen, released, and promoted by climate deniers; or that they revealed a conspiracy by climate scientists to tell lies to the world. Neither was true.

Many of the 'Climategate' emails involved the Climatic Research Unit's director, Phil Jones. The emails revealed how he and others sought to battle against their critics—not through the power of reason but by attempting to marginalise, bad-mouth, and silence their critics. The IPCC has strict rules about open review of the drafts of the chapters, but some of the scientists were conducting back-door discussions outside this process. The emails also reveal how a group of climate scientists tried to subvert freedom of information (FoI) law when it was used by their critics to demand their data. (The details of this are set out in my book *The Climate Files*⁵³.)

None of this shows climate change science to be a fraud. But it does call into question the ability and right of science to carry on policing itself. All is not well in the ivory towers.



None of this shows climate change science to be a fraud.

...if scientists are to be believed ... more openness and oversight are needed.

...we the public—including of course policymakers and the media—need to be more realistic in our expectations of science and of scientists.

What have we learned?

There are two main lessons that I see from all this.

The 'Climategate' affair itself shows that if scientists are to be believed, if the science about climate change and many other controversial areas is to be trusted, then more openness and oversight are needed. And that means more intelligent scrutiny from journalists.

And it means an end to the idea—as common among science journalists as scientists themselves—that journalism is just a conduit for scientists to hand down their tablets of stone to the wider world. That is no more appropriate in science journalism than it would be in political journalism.

The scientists were caught out in the emails—not in telling outright lies and conducting conspiracies—but in oversimplifying their message, and covering up gaps and uncertainties in their research. But in doing this they were responding to what the public and policymakers expect their scientists to be—purveyors of certainty rather than uncertainty.

That leads to a final thought. Yes, scientists need to be more frank with us about what they know and don't know. But also, we the public—including of course policymakers and the media—need to be more realistic in our expectations of science and of scientists.

Managing messages in the media

Brian Fallow
NZ Herald

The state of the media

The state of the media is pretty parlous, and that has implications for people, including climate scientists, who need to communicate to the public via the media.

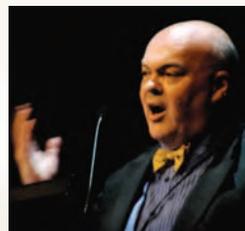
Clearly there is a problem. A survey by the Pew Research Centre⁵⁴ in the United States late last year found that 59 percent of respondents accepted there is solid evidence the Earth is warming. That is down from 79 percent four years earlier. Most of the decline occurred between 2008 and 2009.

The proportion who believes the warming is the result of human activities has fallen from half in 2006 to a third. When asked whether scientists believe warming is due to human activities, 44 percent said yes and 44 percent said no. Four years earlier the split had been 59 percent yes and 29 percent no. The 44 percent who said no are badly misinformed.

A paper published under the imprimatur of the US National Academy of Sciences last year looked at a dataset of nearly 1,400 climate researchers, ranked them by how often they published in the field, and found that, of the top 200, only five could be classified as unconvinced by the tenets of anthropogenic climatic change, as outlined by the IPCC.

It would be unsafe to assume that New Zealanders are a whole lot better served by the news media here than Americans are by theirs. So it is a fair assumption that there is also a wide gap here between scientific opinion and public opinion.

Talking of scientific 'opinion' rather than, say, 'knowledge' means no disrespect to climate scientists. I once heard Rodney Hide in the House invoke a distinction between established scientific fact, which of course had to be respected, and mere theory and conjecture, which we were entitled to ignore. Anthropogenic climate change he put in the theory and conjecture category. Such a distinction sounds fair enough to the layperson.



When asked whether scientists believe warming is due to human activities, 44 percent said yes and 44 percent said no. Four years earlier the split had been 59 percent yes and 29 percent no.

It is not a shortcoming, but rather the hallmark of respectability, in a scientific assertion that it might be wrong and might yet be proven to be wrong. A proposition proof against any future evidence to the contrary is not science, but an article of faith ...

We have to go with the [theory] that explains the most, and is inconsistent with the least, of the available evidence so far. Those who are not qualified to tell which view is which—and that is almost all of us—have to accept what those who are qualified tell us.

...journalists are habituated to the idea that there are two sides to every story.

The only reason it cuts no ice with me is that, as a philosophy student in my distant youth, I was exposed to the ideas of Karl Popper, who was a visiting professor at Otago for a while when I was there. Popper's seminal work in this area is *The Logic of Scientific Discovery*⁵⁵; I recommend it anyone who hasn't read it.

For Popper, Hide's distinction is completely wrongheaded. It is not a shortcoming, but rather the hallmark of respectability, in a scientific assertion that it might be wrong and might yet be proven to be wrong. A proposition proof against any future evidence to the contrary is not science, but an article of faith or some other, lesser thing.

That does not mean, of course, that we are free to shop around and choose whatever theory we like. We have to go with the one that explains the most, and is inconsistent with the least, of the available evidence so far. Those who are not qualified to tell which view is which—and that is almost all of us—have to accept what those who are qualified tell us. So why don't we?

Journalistic norms

A large part of the problem is that journalists are habituated to the idea that there are two sides to every story. Balance requires seeking out and presenting both sides. In most contexts this is a good rule.

If you were a group of journalists, I would be emphasising the need in the case of climate change not to allow that habit of even-handedness to create the false impression that scientists are divided 50:50 on anthropogenic climate change, that 50 to one is more like it. But as you are not journalists, all I can do is make some suggestions about how to try to lean against and pre-empt that tendency.

Communicating with journalists

Don't 'bury the lead'

One problem here is scientists' tendency to present their conclusions festooned by a lot of qualifications and caveats, acknowledging upfront deficiencies in the data they have had to work with and assumptions they have had to make to render the problem tractable. This may be seemly and appropriate when they are talking to their peers. But when trying to get through to the public via the mass news media it can create the impression that their conclusions are more tentative and uncertain and fragile than they really are.

In 2005, the leaders of the 11 most powerful countries in the world gathered for a summit in Gleneagles, Scotland, and climate change was

on the agenda. The national science academies of all 11 countries wrote them an open letter pleading for action. But it did not begin “Now look, for heaven’s sake, read our lips ...”, it began “There will always be uncertainty in understanding a system as complex as the world’s climate ...” Journalists call this burying the lead.

Simplify

This is not to say that the failure of so many of the public to get the message on climate change can be laid at the door of scientists’ academic niceties or semantic fastidiousness. Rather, values like scrupulous accuracy and intellectual honesty are important, but they are not absolute. They are not binary. They depend on context. And when the context is trying to communicate with the public via the mass news media, quick and dirty and simplified is the way to go.

Be aware of journalists’ time constraints

You are as likely as not to be dealing with a journalist who has little or no relevant background knowledge and who—and I can’t emphasise this enough—has very little time to get the story and then tell it.

This is a generalisation, obviously, and relates to the New Zealand context. One of the boons of the internet is that you can access reporting by specialist writers in great and famous papers overseas. And so far that has not disappeared behind pay walls. But that may only be a matter of time. The business models that have traditionally supported newspapers and free-to-air television news are breaking down. They haven’t completely failed yet, but they are under real pressure.



...[Scientists] can create the impression that their conclusions are more tentative and uncertain and fragile than they really are.

Participant comments

Perhaps the ‘main idea’ for scientists (and journalists) needs to be: first the hard-hitting message, and the caveats about scientific uncertainty be kept to the last comment.

Scientists with the ‘knack’ for words should be encouraged to become science communicators to the public—this should be encouraged at university levels.

A positive development ... has been the establishment of the Science Media Centre, to help plug those gaps. They need to be supported.

Participant comment

Journalists are under-skilled and under pressure to present news.

If you ... have to deal with the media ... try writing the story you would like to see appear in print. Give yourself 400 words at the most, or ... talk to it for one minute, tops ... See what you have to sacrifice to get the essential points across.

Technological advances have given people far more options in terms of accessing and sharing information, and there is a widespread conviction that online content should be free. Relentless pressure on media organisations' revenues has led to a hollowing out of newsrooms. The result is fewer reporters and younger reporters, because people get disillusioned and there is a greater rate of churn. It means less chance to specialise and accumulate background knowledge. A positive development on that front in recent years has been the establishment of the Science Media Centre, to help plug those gaps. They need to be supported.

Practise your own sound bites

The hollowing out of newsrooms also means reporters have less time to spend on any given story. If you know or suspect you might have to deal with the media, try this as an exercise. Try writing the story you would like to see appear in print. Give yourself 400 words at the most, or, if you have a webcam, talk to it for one minute, tops. See how far you get within those constraints. See what you have to sacrifice to get the essential points across.

For people used to having a captive audience of students listening to them for an hour at a time, the art of the sound bite does not come easily. Because time is limited, try to avoid wasting it on dealing with the issues sceptics raise. Be conscious of the opportunity cost—any time you spend responding to them is time you don't get to spend making the points you want to make.

Don't waste time refuting sceptics' arguments

There are techniques people use to shut down a line of questioning they can see will take them where they don't want to go. The best is to reject the premise of the question: "That would be a problem, if it were true, but it is not." Or "That's old news. It has been looked at and thoroughly discredited." Dogmatic and dismissive is better than reasonable and forthcoming—unless you want to read a piece that is all about what your opponents are saying. It is the first rule of generalship: don't let the other guy choose the ground. That can be half the battle.

I must confess it rather goes against the grain for a journalist to be saying these things. But the bottom line is we don't have all day and our readers or viewers or listeners certainly don't. So let's devote it to what is important.

Target your message to the medium

There are longer forms, of course, stretching even to the luxurious length of a book or an hour-long documentary. You can write at whatever length you like on a website. But how many people will find it and invest the time in reading or watching it is a hit-and-miss affair. By and large there is a trade-off, an inverse relationship, at work here: the larger the audience, the less time you get to address them. Don't waste it.

Better ways of communicating climate change

Tell stories

Before turning to a couple of areas where I think the message on climate change might be communicated more effectively, I have to make a caveat of my own. I write about the economy, not science or the environment. My occupational interest in climate change over the past 10 years or so relates entirely to what is to be done about it, rather than the thing itself. But I'm convinced most people relate more to words than to numbers and more to images than either words or numbers.



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...most people relate more to words than to numbers and more to images than either words or numbers.

...while scientists may take for granted that there is a big, scary difference between 2 degrees of warming and 4 degrees, to most of us it sounds inconsequential.

Tell us what the world was like the last time there were 600 parts per million of CO₂ in the atmosphere, or the oceans were anoxic.

Another crucial part of the story that I don't think has got through is the question of time lags ... This needs to be reiterated endlessly.

Use past events as reference points

So while scientists may take for granted that there is a big, scary difference between 2 degrees of warming and 4 degrees, to most of us it sounds inconsequential. Parts per million of some gas in the atmosphere even more so. So it is essential to calibrate the scale of what these numbers mean. And preferably by reference to the past rather than the future, just because the past has happened already while the future is always a matter of speculation. Tell us what the world was like the last time there were 600 parts per million of CO₂ in the atmosphere, or the oceans were anoxic.

I remember hearing Peter Barrett describe in a lecture the Greenhouse World of the remote past. To a Southlander with antifreeze in the blood it didn't sound at all inviting.

Emphasise the time lags involved

Another crucial part of the story that I don't think has got through is the question of time lags—how long a CO₂ molecule emitted right now will persist in the atmosphere, how long it takes for an ocean to heat up or cool down, that sort of thing.

This needs to be reiterated endlessly, because otherwise it is easy for people to be seduced by the Bjørn Lomborg view—that there is uncertainty about the science so we should wait until it hardens up, and in 20 years, say, we will be richer and technologically better armed to deal with it. There are more pressing problems in the meantime.

To sum up

The idea is deeply ingrained among journalists that there are two sides to a story. We usually have very little time to get, and to tell, a story. So don't waste it dealing with the issues sceptics raise. Try to stay on message. Remember that most of us don't think in numbers. Calibrate the scale and stress the time lags.

Group dialogue session

Rapporteurs (Ralph Chapman, Judy Lawrence, Amanda Wolf)

Avoiding unitary political activity

State-level initiatives can lead thinking and change in the longer term. In the US, while the Federal Government appears paralysed, California is taking actions, like setting up an ETS and adopting a 30 percent renewable energy target for 2020.

The ideal of GDP growth

Brian Fallow felt that gross domestic product (GDP) is a useful proxy for standard of living. Weaning people off this was tricky, especially with the lower middle class hoping to become better off. Saying we don't want growth is currently pointless in New Zealand. We need to broaden the debate about what is actually valuable to people—providing effective services, while avoiding ecological debt. It is rather like the social marketing of drinking messages: "It's not the growth but the way we are growing that matters." We need to ensure that the growth we foster is the right sort of growth (not fossil fuel-based growth, but green growth).

Getting the ETS in place as part of the 'plumbing' is important. It is not clear how much people need (or want) to know the details. On the other hand, people need to feel the ETS is not corrupt or fixed by the big corporates.



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Journalists tend to frame issues around the political debate surrounding them ...

Dichotomies and polarising tendencies

In an information-dense dialogue it is possible to pick out a number of dichotomies and polarising tendencies. One is the accuracy and precision of science in its presentation and its associated error bars, contrasted with the very blurred view we have of the future of the Earth and its climate. Another is the pairing of hype and hope. A third is portraying scientists as either monks or missionaries.

Polarisation in general is a bad thing because it impedes communication. Erik Conway noted that there needs to be a better set of protocols about how to respond when things go 'wrong', to avoid the polarisation of debates about climate change.

The role of journalists and media

Framing 'the debate'

Fred Pearce felt that editors, media owners, and the nature of the public discourse shape the debate's two sides, and reinforce the landscape.

A lot depends on the positions of the political parties. Journalists tend to frame issues around the political debate surrounding them, reinforcing the existing political debate until someone 'kicks it' in a different direction.

Journalists report what is 'newsworthy'

The role of the media is to make money and reporting is based on newsworthiness. It seems that it is the disasters that become newsworthy and the public will make its own conclusions about them and the relationship to climate change.

However, there is a wide variety of science reporting spanning a range of quality. Some decide to cover climate change in detail, while others just pick up the simple narratives or use response to media interest. The interesting media give an opportunity to people with interesting things to say about the climate debate.

Brian Fallow thought that there had been a shift in the way the public was responding to climate change, becoming less influenced by media.

Science communicators

While the media need educating about science and the nature of the scientific process to improve their reporting to the public, there is also a role for specific science communicators, or translators. This role would be to improve public understanding of scientific method, of uncertainty, of the range of likely impacts of climate change, and of the consequences of our actions.

The role of scientists

Monks or missionaries?

There is a lot of debate about the appropriate role of scientists. The main debate appears to be whether scientists should be 'monks' or 'missionaries'.

Scientists do play different roles. People in-the-know know this, too. The issue is to know which role they are acting in, and whether the role is appropriate for the context. A problem is the failure of this discrimination—a failure to detect when monks act out of character in the wrong setting. If everyone is in 'monk-expectation' mode, but finds that the interaction occurs with a missionary, then expectations and behaviours clash (perhaps unwittingly).

Brian Fallow felt that scientists often get into debates over their heads; they should try to stick to the main messages in their area of expertise. Others felt that it is important for scientists to share their values; that a storytelling model is more effective than a fact-disseminating model; and that more scientists should be involved in outreach, communicate their values, and try to connect to people's daily lives.



...there is also a role for specific science communicators, or translators.

Participant comment

There are more professions available to interpret the science aside from the current two sides represented: scientists and journalists.

Scientists do play different roles ... The issue is to know which role they are acting in, and whether the role is appropriate for the context.

We need to understand the perceptions and expectations that the public has of scientists and scientific institutions.

Participant comment

At the risk of offending very capable and clever scientists, they should stick to what they are good at and let communicators communicate climate change.

...[Scientists are having to do] 40 percent science and 60 percent reactive communication.

Improving public trust in science and scientists

Greater transparency

We need transparency between science, policy, and politics. We need to understand the perceptions and expectations that the public has of scientists and scientific institutions. The IPCC is a translator of science rather than a guardian or producer of science—perhaps the National Academies of Science are the guardians?

Most climate deniers are not climate scientists. The vast majority of reputable climate scientists support the tenets of anthropogenic climate change as set out by the IPCC.

For scientists, and those calling for transparency, it is important to practise what you preach. Being wrong or right is not the main concern with science; rather, the question needs to be does ‘this’ contribute to knowledge?

Better communication

When dismissing deniers, it’s important that not all sceptics are lumped together. Questions should be judged on their merits. Be discerning about who says what. Being cursory and dismissive makes it look as though one has something to hide, or is a propagandist. Fred Pearce called for scientists to be more open and involved in debate by providing snappy, clear messages; communicating with intent; and making it clear what was known and not known.

There was a call from scientists for scientists to be able to do 60 percent science and 40 percent communication, rather than having to respond to numerous questions about the science with the result they were doing 40 percent science and 60 percent reactive communication.



Better understanding of uncertainty and models

Consider the treatment of uncertainty and the use of models. Volatility, non-linearity, and surprise in the financial sector compare with the same in the climate sector. Both matters are complex and difficult to communicate. They turn on whether hard-to-digest expertise satisfies a public's need to know. Yet, we see very different responsiveness in the political and media spheres to what the models and their information tell us.

There are difficulties with trust when models are shown as incorrect and when the experts appear to not know what they're talking about. There are voices clamouring for attention occupying ever-distant edges of the debate spectrum, compelled to yell ever-simpler messages louder and louder. We can see that yelling to out-compete on the simplicity of messages has parallels in the economic and atmospheric domains.

Scientific method

Demand for certainty

There are tensions between the scientific process and the certainty of information demanded by the media and the public.

Science is self-correcting

Erik Conway noted that science is self-correcting by the very nature of the scientific process of peer review. We shouldn't criticise the entire scientific process because a few scientists may have erred. The IPCC process will continue to evolve and be perceived as more open over time, following the reviews being carried out and through the self-correcting process that is part of scientific method.

However, we are still in very early days when it comes to how we respond when things don't go right and how we respond to the sorts of problems that surfaced at East Anglia. On the one hand, we see media conflagrations, blame games, self-defensiveness, even court actions. But where, on the other hand, is the equilibrating process that might take these sorts of things in stride and, importantly, to learn from them and move on?

There are voices clamouring for attention occupying ever-distant edges of the debate spectrum, compelled to yell ever-simpler messages louder and louder.

Participant comment

A set-back has occurred with the Christchurch earthquake—a blurring of natural forces and anthropogenic change—the media doesn't make a distinction.

...science is self-correcting by the very nature of the scientific process of peer review.

...[Where] is the equilibrating process that might take these sorts of things in stride and, importantly, to learn from them and move on?

How do we match 'feel good' with 'do good'?

Local implications of climate science for people

Feeling good while doing good

We can query the local implications of climate science for people. People are living their lives, having hopes, sometimes taking part in actions like Earth Hour or Project 350. They may feel good, but do they also do good? How do we match 'feel good' with 'do good'?

Public 'need to know'

What does the public really need to know and how can this be reconciled with a short attention span? We have people living their lives, without evident need to understand what is reported on page 735 of the IPCC report. Yet, in living those lives, they can be supported to build up their resilience and that of their communities so that they have the lives they want—and the sort of resilience-building activities and actions that have climate benefits (achieving outcomes whilst totally sidestepping 'science').





3 | Human behaviour and the capacity for change



What limits more widespread pro-environmental behaviour on the part of individuals for whom such actions are feasible?

Obstacles to desired behavioural goals, or 'dragons of inaction' ... fall into seven genera, each of which contains subspecies, and all 30 dragons hinder positive action.

Dragons, mules, and honeybees: Why we do less than we should, and how we can overcome

Professor Robert Gifford
University of Victoria, Canada

If so many people are concerned about the environment, why aren't more of us doing what is necessary to ameliorate the problems?

Of course, many individuals and organisations have taken many steps in this direction, and others actually are helping the environment without intending to; these are mentioned later. However, as a whole, humans continue to degrade the environment and produce massive quantities of GHGs.

In some cases, the reasons for this are structural, and therefore beyond an individual's reasonable control. For example, a low income severely limits one's ability to purchase solar panels, living in a rural area usually means that public transport does not exist as an option to driving, and living in a region with very cold winters greatly restricts one's ability to reduce home-heating-based energy use. However, for many others who are not held back by structural barriers, many beneficial environmental choices are possible, but are not adopted, at least to the extent necessary. Thus, the question remains: What limits more widespread pro-environmental behaviour on the part of individuals for whom such actions are feasible?

Obstacles to desired behavioural goals, or 'dragons of inaction' as I call them, fall into seven genera, each of which contains subspecies, and all 30 dragons hinder positive action.

Seven Dragon Genera

(Incorporating 29 species in all)

- Limited Cognition
- Ideologies
- Other People
- Sunk Costs
- Discredence
- Perceived Risks
- Limited Behaviour



Limited cognition

Humans are famously less rational than once believed. This is as true for thinking about environmental issues as it is in other behaviour domains.

Ancient brain

The human brain has not evolved much in thousands of years. At the time it reached its current physical development, before the development of agriculture, our ancestors were mainly concerned with their immediate tribe, immediate risks, exploitable resources, and the present. These here-and-now concerns are incompatible with solving environmental problems, which often involve distant risks and delayed impacts. Our ancient brain is capable of dealing with global climate change, but it does not come naturally.

Ignorance

Some people simply remain unaware of key environmental realities. Others are paralysed by a lack of knowledge about which actions to take, how to undertake actions of which they are aware, and the relative benefits of different actions.

Environmental numbness

Our phenomenal world is composed of more cues than we can monitor, so we attend to selected elements of it. Thus, people often are unaware of problematic environmental elements, such as subtle changes in the climate. Behaviour change is unlikely when this is the case.

Uncertainty

Research demonstrates that perceived or real uncertainty reduces the frequency of pro-environmental behaviour. In general, people interpret uncertainty in ways that serve their self-interest. If I believe that global warming may not be occurring, and I desire a fuel-inefficient vehicle, I will be tempted to buy it.

Judgemental discounting

The discounting dragon leads people to undervalue geographically distant risks. We recently found in a multi-national study that people believed environmental conditions were worse in countries other than their own—and, of course, people in those countries believed the same thing about other countries. When problems are presumed to be worse elsewhere, people are less motivated to improve their own environment.

Humans are famously less rational than once believed. This is as true for thinking about environmental issues as it is in other behaviour domains.

Participant comment

If our brains are not designed to think about future impacts of our current behaviours, how has the act of booking Rugby World Cup tickets years in advance become normal for some people? Others buy antiques or art, thinking now about the value they will have in the future (50–100 years). There is a whole international market set up to trade in future shares—anticipated values for stocks not yet in circulation. How do so many brains engage with that? Seems to me we do imagine our futures and act on these imaginings in many ways every day, so we can imagine futures where we take better care of our environments and act on that aspiration right now and here today.

Some belief systems are so broad that they pervade many aspects of a person's life. Among these are religious and political views that can be strong barriers to behaviour change.

Optimism bias

Optimism generally is healthy, but it can be overdone. For example, people underestimate their risk from 22 environmental hazards. Underestimation of risk obviously hinders pro-environmental action.

Lack of perceived behavioural control

Because some problems, like climate change, are global, many people believe that, as individuals, they can do nothing about it. Similarly, some believe that nothing can be done even by collective human action.

Ideologies

Some belief systems are so broad that they pervade many aspects of a person's life. Among these are religious and political views that can be strong barriers to behaviour change.

Political worldviews

One source of inaction on global warming is unfettered belief in free-enterprise capitalism.

System justification

"I'm all right Jack—don't rock the boat." This is the tendency to defend the societal status quo.

Suprahuman powers

Some people take little or no climate-positive action because they believe that a religious deity or Mother Nature (as a secular deity) is in complete control. Naturally, inaction follows.

Technosalvation

Mechanical innovation has an admirable history of improving our standard of living. Technology obviously can help with environmental problems, but some go further and believe that technology alone can solve the problems. Overconfidence in the efficacy of technology can serve as a barrier to one's own pro-environmental behaviour.

Significant others

Humans are social animals; we compare our situation to that of others. These comparisons take three main forms.

Social comparison

People compare their situation to others. If significant others, family, and friends are not doing their part, citizens are likely to decide that they should not exert efforts either.

Social norms

People look to others to derive their norms about what the 'proper' course of action is. Norms can be a force for progress in environmental issues, but they can also be forces for regress.

Perceived inequity

Perceived (in)equity is often heard as a reason for inaction: "Why should I change if they won't change?" Well-known persons, organisations, or other nations are cited as polluters, and these are used to justify one's own non-action.

Sunk costs

Investments of money, time, and in behaviour patterns are valuable—unless they are harmful to the environment.

Financial investments

Once invested in something, dispensing with it can be difficult. If one has purchased a car and is now paying for its insurance and other costs, why should this cosy portable living room be left at home?

Behavioural momentum

Many habits are extremely resistant to change. Some that contribute to environmental degradation (such as the use of cars) have a great deal of behavioural momentum.

Conflicting goals and aspirations

Everyone has multiple goals, and many of these clash with the goal to improve one's environmental choices. Being willing to combat climate change, for example, is not compatible with aspirations such as buying a larger house, flying to new locations, or driving a bigger car.

Humans are social animals; we compare our situation to that of others.

Everyone has multiple goals, and many of these clash with the goal to improve one's environmental choices.

When people begin with a basic disbelief in others' views, they are unlikely to take direction from them.

Participant comments

People believe those whom they know and trust.

Have people lost trust in the scientists? Have they lost trust in the news media? How do we regain that trust? Through more varied forms of media—blogs and alternative media sources.

'Trust' is relative. Compared to used car salesmen, scientists are well trusted.

If trusted advisers are important in the political process, should we be identifying them or providing them with a view to providing a common voice?

Lack of place attachment

Individuals may be more likely to care for a place to which they feel attachment than for one they do not. Place attachment is complex, but the lack of it probably acts as an impediment to action in some contexts. For example, evidence suggests that nature-based place attachment but not civic-based place attachment is related to pro-environmental behaviour.

Discredence

When people begin with a basic disbelief in others' views, they are unlikely to take direction from them. For example, if scientists and politicians are disbelieved as a matter of course, suggestions from them to be green are likely to be ignored.

Mistrust

Trust is essential for healthy relationships. When it is absent, as it is between some citizens and scientists or government officials, resistance to their behaviour-change suggestions will follow.

Perceived programme inadequacy

Policymakers have implemented many programmes designed to encourage climate-friendly behaviour. However, citizens choose whether to accept these offers, and often decide that the programme is not good enough for their participation.

Denial

Mistrust and reactance easily slide into denial. This may include denial that climate change is occurring, that it has any anthropogenic cause, or that one's own actions play a role in climate change. Mitigation is unlikely to follow.

Reactance

Some people strongly react against policy that seems to threaten their freedom. This can go beyond denial to actively choosing climate-harmful products to spite the policymaker.

Perceived risk

Changing behaviour holds at least six kinds of potential risk: functional, physical, financial, social, psychological, and temporal.

Functional risk

Will it work? For example, if one purchases an electric vehicle, it may, as a new technology, have battery problems. The same could be said for many new green technologies.

Physical risk

Some adaptations may have, or be perceived as having, danger to self or family. Is this electric vehicle as crash-safe as the SUV that I sold to buy it? Bicycles are great for climate change, but may result in a visit to an emergency room.

Financial risk

Green solutions require capital outlays. How long is the payback? If the product becomes a fixed part of a residence (like solar panels), will the owner recoup the installation costs or accrue enough energy savings before moving?

Social risk

Others notice our choices. This leaves us open to judgement by our friends and colleagues, which could lead to damage to one's reputation. If I ride my bicycle, will my significant others deride me behind my back?

Psychological risk

If one is teased, criticised, or even rebuked by one's significant others for making some green choice, one risks damage to one's self-esteem in addition to the social loss.

Temporal risk

The time spent planning a green course of action might fail to produce the desired results. Most people spend considerable time deciding whether to buy an electric vehicle, become a vegetarian, or plan how to cycle to work or school. What if it doesn't work out? The time was wasted.

Changing behaviour holds at least six kinds of potential risk: functional, physical, financial, social, psychological, and temporal.



Many people are engaged in at least minimal pro-environmental action. However, most people could do more than they are. How do they justify doing less than they should?

Certain structural barriers stand in the way of behavioural changes that would help, [and] many psychological barriers remain for individuals who do not face structural barriers ...

Participant comments

We know attitudes don't lead to actions automatically.

Psychological barriers should be targeted!

How do we use behavioural/motivational studies at the individual level to mobilise community and national action on climate change?

Limited behaviour

Many people are engaged in at least minimal pro-environmental action. However, most people could do more than they are. How do they justify doing less than they should?

Tokenism

Some pro-environmental behaviours are easy to adopt, but have little impact on the big problems. "I recycle, so I've done my part." This ease of adoption means that these actions tend to be chosen over higher-cost but more effective actions.

The rebound effect

After some mitigating effort has been made, the gain is often diminished or erased by subsequent actions. For example, after buying an electric vehicle, people may drive further.

Is there any hope?

No

Certain structural barriers stand in the way of behavioural changes that would help, but many psychological barriers remain for individuals who do not face structural barriers, including limited cognition, ideologies, significant others, sunk costs, discredence, perceived risks, and limited behaviour. Some structural barriers might be removed, but this is not likely to be sufficient.

Maybe

Psychologists and other social scientists have an important role to play if these psychological barriers are to be overcome.

Briefly, five strategies are:

- 1 Better understand the barriers that different groups of people face:
 - Which are easiest, cheapest to overcome?
 - Which are simply not going to change?
 - Conduct a psychological cost-benefit analysis.
- 2 Educate people about the differential efficacy of pro-environmental actions.
- 3 Improve education about climate change and communicate the problem more effectively.
- 4 Design, implement, and evaluate more attractive interventions.

- 5 Work with other experts and policymakers; each discipline has valuable skills, and all are necessary if we are to succeed in this grand challenge.

Yes

Mules

Many people are taking many steps to mitigate climate change. These people are in the minority, but are carrying heavy loads of responsibility and action. For that reason, I call them (with affection and admiration) the mules.



Honey bees

Another group is mitigating climate change and related sustainability problems, but, perhaps surprisingly they don't even claim to be doing so. These are the people who cycle for health reasons, remain childless because they choose not to have children, use very little in the way of resources either because they are poor or have chosen simplicity as a lifestyle. Because they help without intending to, I call these people honeybees; the insects of that name keep us all in food, but their own goals are to serve their hive, not to feed us.



Many people are taking many steps to mitigate climate change.

Another group is mitigating climate change and related sustainability problems, but, perhaps surprisingly, they don't even claim to be doing so.

Participant comment

What are the proportions of honey bees and mules in society?

Participant comments

I think there is a need to shift the focus of climate change away from 'climate change' as such. There are a number of other areas where significant changes could be made that would benefit climate change action without having any mention of climate change. There is a great need to reframe this issue.

When discussing specific jobs in green technology, describe the training, the actual work entailed—before speaking of the reasons for these jobs (ie combating climate change).

The co-benefits of action are more important motivators.

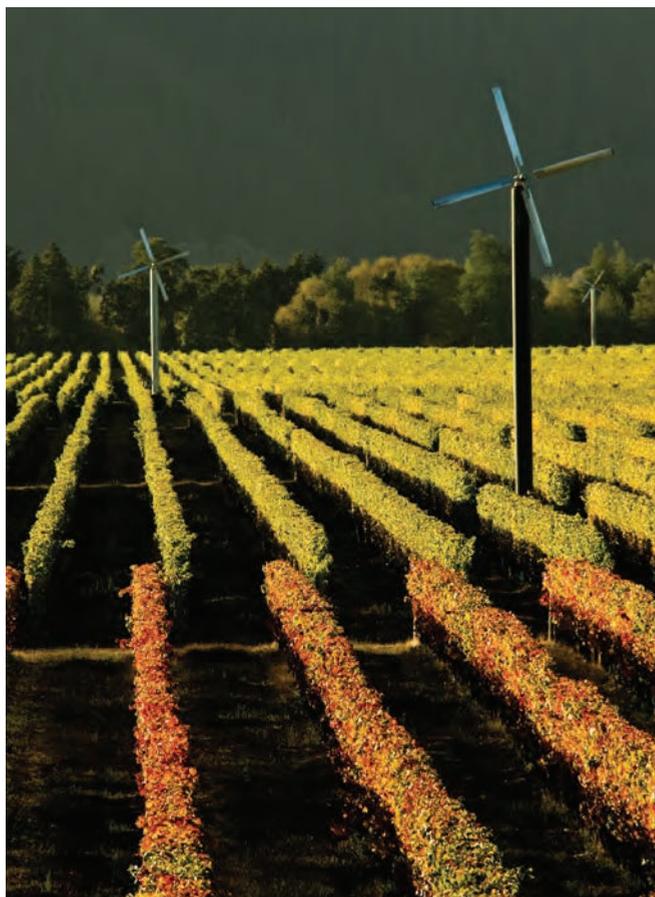
Framing messages

Which sorts of messages work?

- Use empowering messages, not sacrifice messages.
- Use identified messages for mules (but not for honey bees); use intrinsic messages for honey bees (but not for mules).
- Use messages about local issues.

Remember:

Climate action = Mules + Honey bees – Dragons



Addressing dangerous climate change: Why citizenship matters more than behaviour change

Dr Bronwyn Hayward
University of Canterbury, New Zealand

Addressing climate change effectively will require much more than a change of behaviour, we will need to rethink the basic principles of our economies and our democracies, including how we understand our citizenship.

It is citizenship that I focus on here, firstly on the transformative possibility of citizen action. Secondly, I consider whether behaviour change is a legitimate basis for public policy. Finally, I ask whose behaviour needs to change and why?

A 'shaky' introduction

I begin by acknowledging that I am currently standing on very shaky ground. On 22 February 2011, Ruamoko, the god of earthquakes, unleashed his energy in a series of aftershocks that devastated my home city of Christchurch. The New Zealand head of the Reserve Bank, Dr Alan Bollard, has since described the quake events that hit Christchurch as "one of the biggest natural disasters in relative terms to befall an OECD country since World War II"⁵⁶. One hundred and eighty-one people were killed and many more injured. Like everyone from Christchurch, my contribution here is set against the background of the tragedy unfolding in my provincial city.

Whenever a disaster threatens a community, whether it's a series of slow, cumulative, almost imperceptible daily changes like a change in climate or a sudden cataclysmic event like an earthquake, dangerous environmental change tests more than our physical infrastructure, it tears at the fabric of economies, our society, and our democracies.

How we respond to the threats of a disaster will be affected by what has gone before—our relationships, our experiences, and our cultural and spiritual depth as a community⁵⁷.



Addressing climate change effectively will require much more than a change of behaviour, we will need to rethink the basic principles of our economies and our democracies including how we understand our citizenship.

How we respond to the threats of a disaster will be affected by what has gone before—our relationships, our experiences, and our cultural and spiritual depth as a community.

Psychology has taught us a great deal about how we respond as individuals to dangerous threats. However, I argue it does not fully explain our potential to act as citizens.

Participant comment

Psychology doesn't only consider individual aspects but also social and cultural aspects.

However, with the grief of disasters comes opportunity for new insights into our past and our future. Amid the turmoil of the earth cracking and the rubble of the stone buildings of Christchurch (an English delusion we probably should never have built, but which we loved anyway), there have been some significant opportunities to rethink basic principles and I draw here on some of these experiences as I begin to rethink citizenship and to articulate my concerns about the political limits of individual behaviour changes as a response to a changing climate.

Rethinking citizenship and behaviour change

Psychology has taught us a great deal about how we respond as individuals to dangerous threats. However, I argue it does not fully explain our potential to act as citizens.

Robert Gifford has helpfully explained the way our 'ancient brain' influences individuals. As a result, individuals are often good at processing strong visceral reactions to immediate danger but struggle to engage in reasoning to address long-term threats like a changing climate. Gifford has described the way that individuals tend to create 'psychological dragons' that inhibit them from acting in ways that might better address the threats and problems of climate change. His work resonates with the recent writing of Clive Hamilton (2009)⁵⁸ and Anthony Giddens (2009)⁵⁹, both of whom have also considered how individuals react to dangerous threats with patterns of denial, distraction, blaming others, or enforced optimism—all of which tend to be unhelpful ways of dealing with difficult, long-term climate change.

There is recent thoughtful research in how we process collective emotion about changes in our environment

For example, when faced with dangerous environmental changes, a community often experiences emotions of grief and compassion⁶⁰. In the immediate months after the February quake, Christchurch residents experienced a typical surge of mutuality or goodwill. Now we are currently entering the period of intense anger, tension, and blame that is also often associated with natural disasters⁶¹. Constant aftershocks tend to keep creating periods of renewed crisis and grief; however, we can expect that over time this tension will ease, and be followed by a period of vision, and then usually (but I hope not inevitably) by the reassertion of old power relationships and underlying socio-economic inequalities^{62 63 64}.

Understanding our individual and collective psychological responses to environmental change does not mean that our psychology will inevitably determine how we address the threats of climate change as citizens. When we act as a citizen, we act in a different way from the way we act as individuals. There are many times in political history where citizens have taken action against overwhelming odds.

It is possible to imagine other ways of responding to a changing climate, that might change the trajectory of our future so we are not just enhancing the resilience of our communities (that is not simply bouncing back to reinforce our existing patterns of behaviour or underlying power relationships), but actually transforming our communities in ways that might be more socially equitable, fairer, and less damaging to the environment.

What are some of those preconditions of citizenship that might enable us to act differently?

When, as citizens, do we act with courage, or trust despite our fears? When do we act with hope as determination or with faith in an 'unrealised possibility' as Hannah Arendt⁶⁵ would say?

To begin to answer this question, I turn to our experience of the Christchurch earthquake and to students: Sam Johnston and six others, who first organised 1,000 students in September 2010 at the time of 7.3 magnitude quake. Building on what they learned in that experience, it took only a week after the February aftershocks before that small group of students were communicating with 24,000 people. It wasn't just Facebook and Twitter that enabled this astonishing, youthful political coordination. There was a raft of pre-existing conditions that enabled these young citizens, and many communities like them around Christchurch, to act in new ways⁶⁶. One of the first common features of these successful citizenship initiatives is that they built on existing organisations and networks, improving their communication and relationships within and between groups and across national boundaries⁶⁷.

It is possible to imagine other ways of responding to a changing climate, that might change the trajectory of our future so we are ... actually transforming our communities in ways that might be more socially equitable, fairer, and less damaging to the environment.

Participant comments

Avoid paternalism when it comes to young people finding their own solutions

Have faith in the younger generation to (eventually) get the planet sorted. You taught us!

One of the first common features of these successful citizenship initiatives is that they built on existing organisations and networks...

There are many other examples of communities acting in the face of seemingly overwhelming odds.

Participant comments

Nurturing rather than keeping children stuck in these rigid 'right-wrong' boundaries in the education system today is important.

Data and information cannot be analysed without educated and curious imaginations—how can we protect and nurture social and education policies that value imaginative work?

... I am alarmed at current intellectual streams of thought which seek to unite individualistic psychology and behavioural economics with a resulting emphasis on identifying behaviour change policies as the solution to climate change.

Communities and young people are already acting

There are many other examples of communities acting in the face of seemingly overwhelming odds. Witness the thousands of young citizens who are currently taking to the streets in protest all over the world at present, from Tunisia to Madrid. Today's 1.2 billion teenagers face very grim futures and could be forgiven for 'giving up', yet many are acting politically anyway. UNICEF's 2011 State of the World's Teenagers report paints a picture of terrifying youth unemployment. In the Middle East alone, 65 percent of the population will be under the age of 25 in a decade. UNICEF estimates we will need to create 6.5 million jobs every year for the next 10 years for the average 13-year-old in that region to be employed when they are 23⁶⁸.

Young teenagers protesting internationally are not protesting about climate change, they're protesting the grim economic reality of skyrocketing youth unemployment and lack of voice in decision making. Yet it is these economic and governance arrangements that have combined to fuel continued extraction of the resources of the planet beyond its natural limits⁶⁹. In short, young people are already acting in significant ways as citizens, mounting strong protest about the complex social and economic conditions that are also destabilising our climate. We do not need to change the behaviours of these young adults, as much as we need to listen to what they are saying.

When 'nudge' comes to shove: Finding a legitimate basis for democratic policy

With respect to many colleagues, I am alarmed at current intellectual streams of thought which seek to unite individualistic psychology and behavioural economics with a resulting emphasis on identifying behaviour change policies as the solution to climate change.

Nor do I agree that psychology is necessarily a legitimate basis for democratic decision, particularly as expressed as the liberal paternalism of nudge theory⁷⁰. In a recent address to the Resolve Conference on Sustainable Lifestyles, Baroness Neuberger (Chair of the British House of Lords' behaviour-change inquiry), noted the disquiet raised by many over the current direction of behaviour-change policy^{71 72}. Her nuanced speech highlighted the reservations of many about the lack of opportunity to debate behaviour-change policy.

To achieve lasting and significant transformation to our society and our economy, we will need to make significant changes to the conditions of our social and economic life. This type of lasting and transformative change will take a shove rather than a nudge. But such far-reaching policy changes demand inclusive and explicit public debate if they are to be accepted as a legitimate, democratic policy response.

Whose behaviour needs to change?

The behaviours that most urgently need to change are those of the baby boomers and the corporations, including the international financial investment and insurance companies they have created. These major players have far-reaching ability to shape the world that today's children inherit. Yet there is very little political incentive to regulate these global corporate citizens, and a great deal more interest in focusing on small-scale individual changes. Why is this? Could it be that it does not suit the baby boom generation to regulate the very industries that have provided them with their wealth?

Conservative politician and writer David Willets speaks in his book *The Pinch* (2010)⁷³ of stealing from our children. His work reminds us that it's not baby boomer psychology that we need to worry about, so much as their sheer political clout at the ballot box, and the clout of the companies that they have created. It is the baby boom generation who has benefited from years of low-cost home loans, free state education, low inflation and ability to travel and export widely, from the shift from public to private funding of services and from pension plans, insurance schemes, and investments in forms of economic growth that have resulted in climbing youth unemployment and resource extraction beyond our planet's limits.

However, as an older generation we have the ability and privilege of reflecting backwards and looking forwards. We can and must rethink our obligations of citizenship to future generations and then act to change the ways we exercise our economic and political power. An effective first step is to develop political commitment devices such as taxation arrangements, pension schemes, and a commission for future generations that will help to shift the environmental, social, and political burdens we are currently placing on our children's future, back to our lives now. The behaviours we need to regulate most urgently are our own and those of the companies we have created.

Participant comment

We need to move away from the dominance of psychology and economics of climate change to instead encompass a wider range of theories and conceptions and ideas about climate change from sociology, human geography, and anthropology.

We can and must rethink our obligations of citizenship to future generations and then act to change the ways we exercise our economic and political power.

Participant comment

We need to remember climate change is a symptom of something, not an extraneous problem. We need to ensure we are considering it in that context.



The political process has difficulty dealing with complex long-term issues. Climate change is an exemplar.

Participant comments

Politicians get punished for taking strong leadership on any issue not mainstream. Where is the reward for leadership?

Climate change should not be a partisan issue.

How democratic processes can deal with complex long-term issues

Professor John Thwaites
Monash University, Australia

The political challenge of climate change

The political process has difficulty dealing with complex long-term issues. Climate change is an exemplar. We are asking people to bear some costs now (such as higher electricity prices) for benefits that are perceived to accrue in the future (cleaner energy generation and a safer climate). Getting public support for such action is challenging, as illustrated by the old political saying “what has posterity ever done for me?”

For the political process to deal with complex long-term issues like climate change, political leaders need to have both a political strategy and a public-engagement strategy. The political strategy includes strong leadership, good communication, a media strategy, key stakeholders on-side, and, importantly, getting the numbers in parliament. The public-engagement strategy needs to link community engagement with a behaviour-change strategy that is informed by an understanding of psychology and behaviour-change theory. This was missing in the Australian Government’s attempts to pass the Carbon Pollution Reduction Scheme (the CPRS) in 2009 and 2010.

Complex social planning problems are sometimes referred to as ‘wicked problems’, as it is difficult to find solutions to them. Wicked problems often have multiple causes and attempted solutions may have unforeseen consequences. They are difficult to define and there is often disagreement among stakeholders about both the causes of the problem and potential solutions. The debate about climate change exhibits these characteristics.

Governments in Australia have in the past successfully tackled some complex long-term problems. The Hawke-Keating Government’s economic reforms and the introduction of national compulsory superannuation are examples. Both of these were major economic reforms and faced opposition at the time, but are now generally regarded as having major benefits for society. In my Ministerial career, I was confronted by a number of complex issues include drugs, water reform, climate change, social disadvantage, and planning for more sustainable cities.

The nature of modern government

To think about how to solve these complex issues, we need to really understand modern government.

- Power is very centralised at the top with the Prime Minister or Premier.
- There is intense time pressure on the Prime Minister and Ministers. There is no time for contemplating and reflecting on complex problems in the way they need.
- There is 24-hour media power. Decision making is often done on the spur of the moment, in response to a bad media story coming out the next day. An example was the announcement by the Rudd Government of its decision to defer an ETS in Australia.
- Almost every few days there is a media poll that becomes the subject of political discussion. This is not conducive to long-term decision making.
- There is a state of permanent conflict between the political parties who are continuously campaigning for the next election. While the philosophies of the parties have converged to a degree, the partisanship has become exaggerated. This makes it difficult, if not impossible, to work in a bipartisan way on complex long-term issues that will impact over many terms of government.
- The media, particularly the print media, plays up conflict and campaigns on many issues. Much of the media in Australia has focused far more on the conflict between scientists and climate sceptics than on reporting solutions.
- Vested interests have considerable power and vast sums of money to spend on advancing their position. In Australia, businesses opposed to a carbon price have considerably outspent the Australian Government in advertising their position.
- The intense time pressure on political leaders, the complexity of issues, and the permanent level of conflict has led to the increased importance of a few trusted advisers to political leaders.

There is a state of permanent conflict between the political parties who are continuously campaigning for the next election. While the philosophies of the parties have converged to a degree, the partisanship has become exaggerated.

Participant comments

How do you get the population to make responding to climate change a higher priority in their everyday lives and encourage their involvement in the democratic process?

Do we need to do more than be in a position to answer, positively, the question 'What's in it for me?'

...the credibility and trust that the respective party leaders hold may have a bigger role in determining public attitudes to key policy issues than the substance of the issues themselves.

Participant comment

I believe that NZ has a unique potential for community/deliberative/participatory/consensual decision making simply because it has such a small population.

It may well be easier to legislate for difficult issues in New Zealand, where there is only one House of Parliament, than in Australia where the two Houses are often of different political complexions.

Key political factors

Politics is increasingly presidential in Australia. It is portrayed as a contest of leaders more than a contest of parties or policies. So the credibility and trust that the respective party leaders hold may have a bigger role in determining public attitudes to key policy issues than the substance of the issues themselves.

Having said that, the numbers in politics are often very close. Persistence, resilience, and hard work pay off. For example, the ETS in Australia would have been legislated in 2009 if one more person had voted for Malcolm Turnbull in the Liberal Party leadership spill. It looks likely that the carbon price legislation will pass the Australian House of Representatives this year by one vote.

Factors affecting the difficulty of achieving change

There are many factors affecting the difficulty for political leaders in achieving change and providing solutions to complex long-term problems. These include:

- the size of the change
- complexity
- community support
- vested interests—powerful opponents and supporters
- ‘elite’ opinion
- media attitude
- opposition stance—partisanship (it is easy for the opposition to exploit the short-term selfishness of some people)
- parliamentary situation—what the numbers are in parliament.

The parliamentary situation should not be underestimated. Whether the legislature is bicameral or unicameral can be critical. It may well be easier to legislate for difficult issues in New Zealand, where there is only one House of Parliament, than in Australia where the two Houses are often of different political complexions. The recent political sclerosis in the United States is an even more extreme example of the difficulty in solving complex issues with divided legislatures.

Political leaders need to have a political strategy if they are to overcome the various challenges thrown up by wicked problems like climate change. In my experience, there are Ten Commandments that need to be followed.

The Ten Commandments of political success

- 1 Be a leader.
- 2 Have the courage of your convictions.
- 3 Be trusted.
- 4 Know what you want to achieve.
- 5 Communicate, persuade, educate.
- 6 Engage—develop plans collaboratively.
- 7 Know what stakeholders want to achieve.
- 8 Do a deal—this may involve trade-offs.
- 9 Be persistent.
- 10 Keep the numbers.

Engagement and behaviour change

Complex issues require public engagement and behaviour change as well as political change. Legislation alone cannot fix these things.

Engagement is necessary to build political and stakeholder support, to ensure practical implementation, and, in many cases, to come up with better policy proposals than politicians and bureaucrats acting alone. Government leaders need to determine what the purpose of the engagement is. Providing information is rarely enough, but often that is all government does. Engagement may merely involve consultation to obtain feedback or it may involve deeper participation and collaboration with active public involvement in decision making.

In many cases, complex problems will not be solved unless people's behaviour changes. This is particularly the case when there are multiple causes of a problem (such as obesity, drug use, disadvantage), when the issue depends on community behaviours (such as carbon emissions, energy, and water use), and when government action is limited by community attitudes (such as carbon prices, speeding fines).

Politicians should also consider the difference between public attitudes on issues and actual behaviours. Both are important, but general attitudes on issues such as climate change are not always a good guide to actual behaviours.

In many cases, complex problems will not be solved unless people's behaviour changes. This is particularly the case when there are multiple causes of a problem ... when the issue depends on community behaviours (such as carbon emissions ...), and when government action is limited by community attitudes.

Participant comment

In fisheries management we referred to the 10-80-10 rule in fisheries compliance: 10 percent will always follow the rules, 10 percent will always break the rules, and 80 percent can go either way, based on the reasoning for the rules. In climate change this same split may also be seen. I feel we spend too much time on the 10 percent that will never believe the climate change debate, and not enough time on the 80 percent.

For many individuals, particularly those with individualistic or hierarchic values, climate change policy challenges their worldview and studies show they are less likely to believe in climate science.

Participant comment

We place too much responsibility on the government to make solutions/communications/behaviour changes. The government will respond to the public making these changes. We need more bottom-up movement—it will become the social norm to see climate change as a problem and take action to prevent it and adapt to it.

We need to understand the differences in target groups and target messages and activities to them. This includes understanding the influence of political and cultural views.

Attitudes about climate change

There has been very little action on climate change compared to the decisive action following the global financial crisis. In fact, support for climate action appears to be decreasing. Polls show that while large majorities of people want climate action, they don't want to pay much for it. Public attitudes towards carbon prices are also strongly influenced by political party support. In Australia, supporters of the Coalition are much less likely to support a carbon price than Labour supporters.

The problem of human psychology

Climate change doesn't readily prompt behaviour change because the human brain evolved to respond to threats that are immediate and can be appreciated by our senses. By contrast, long-term climate change is hard to detect from personal experience. Many of the risks seem remote and in the future. We know from psychology that humans heavily discount future risks and benefits. For many individuals, particularly those with individualistic or hierarchic values, climate change policy challenges their worldview and studies show they are less likely to believe in climate science. Finally, most of us have a finite pool of worry and the negative messages about climate change tend to get ignored if repeated too often.

It's difficult. So what can we do?

In short, we have to do everything.

The first thing is to think about who we are trying to influence. We need to understand the differences in target groups and target messages and activities to them. This includes understanding the influence of political and cultural views.

Then we have to use all the tools available:

- Collaboration and empowerment
- Financial incentives
- Psychology
- Behavioural economics
- Social marketing
- Regulation

Finally, we have to make the actions we seek easy to do. Humans are creatures of habit and our traditional behaviours will not change unless we make it as easy as possible.

Communication and psychology

Political leaders can be assisted by insights from psychology when they communicate and seek to influence behaviours.

How information is presented can impact on responses. Framing and language are important. For example, people respond better to frequencies—1 out of 1,000—than to percentages—0.1 percent. People cling to misinformation that they already have, so put things in the positive. Don't repeat negatives—a myth-versus-fact approach can backfire as the audience may only remember the myth.

Social norms are powerful. People are very influenced by their perception of what others do in a specific situation and by what others commonly approve or disapprove of. Householders are more likely to conserve water or energy if they are informed that they are using more than their neighbours.

Attitudes are hard to change but behaviour can be 'nudged'. Governments can guide small changes in behaviour by using an understanding of psychological factors like social norms. In some cases these behaviour changes may change attitudes as well, as people tend to adopt attitudes that are consistent with their perceived behaviour.

As Minister for Water in Victoria between 2002 and 2007, I was involved in a successful behaviour-change campaign that saw a reduction in water use per head of more than 20 percent. This was an important response to climate change, which is leading to a reduction in rain water flowing into Melbourne's reservoirs. The campaign significantly reduced household and business water use. Individual behaviours that were encouraged included shorter showers, purchase of water efficient appliances, and low-water-use gardens. As well as changing behaviours, the campaign affected attitudes and built support for water conservation, water saving rules, and higher water prices.

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Attitudes are hard to change but behaviour can be 'nudged'. Governments can guide small changes in behaviour by using an understanding of psychological factors like social norms.

We need a political strategy for combating complex issues like climate change as well as a community engagement and behaviour-change strategy. These strategies must be mutually reinforcing.

The water conservation campaign involved many of the aspects discussed above including:

- political leadership from the top—the Premier
- participation and engagement with local communities
- a social marketing campaign
- the use of social norms by giving households and businesses information about water use by their peers
- financial incentives
- water-saving rules and restrictions (that reinforced the social norms).

Conclusion

We need a political strategy for combating complex issues like climate change as well as a community engagement and behaviour-change strategy. These strategies must be mutually reinforcing. Political leaders can be assisted in implementing solutions to these complex problems by insights from psychology and behaviour-change theory.



Figure 6 Dealing with complex long-term issues

Group dialogue session

Rapporteurs (Ralph Chapman, Judy Lawrence, Amanda Wolf)

Reinforcing and sustaining change

Create a sense of empowerment

It is important to create a sense of empowerment and inclusion to reinforce and sustain change. One way of doing this could be to ask people what signs of change they notice locally.

Maintain momentum

Avoiding climate fatigue is a big challenge—the challenge of maintaining momentum. We can learn from social-marketing campaigns, such as the anti-smoking campaign. A main lesson from the anti-smoking campaign is to break action into lots of small steps, which people tend to accept more readily than larger steps. An example of this is in British Columbia, Canada, where a 2 percent carbon tax has been absorbed and handled. The lesson from psychology is that people tend to be prepared to accept small sacrifices.

Reframing climate change to align with people's existing concerns

Exploit co-benefits

Robert Gifford's idea of 'honey bees' means increasing collective action on climate change by building on what people are interested in and already doing that targets climate change, even though they may not realise it.



It is important to create a sense of empowerment and inclusion to reinforce and sustain change.

Tying climate change concerns to health, employment, social, and economic concerns is an effective way of increasing action while side-stepping the need to increase support for climate change action.

We need to make it easy for people to make climate-friendly decisions in situations when they are already prepared to make changes.

By avoiding labelling campaigns as 'climate change campaigns', we can exploit co-benefits that may appeal more to different groups, such as the health benefits of cycling, or the financial savings on parking and petrol. Tying climate change concerns to health, employment, social, and economic concerns is an effective way of increasing action while side-stepping the need to increase support for climate change action

Reframing the debate about climate change in a range of different moral frameworks could also be a way of broadening the support base.

Build collective action

Each individual can't do everything but we can leverage collective action through a strategy of influence and leadership, and by building a constituency. If people are sceptical about climate change, they will need opportunities created for them, such as insulation rebates, cycle lanes.

Take advantage of moments for change

This ties in to the concept of exploiting moments for change. For example, the time when someone is doing home renovations could be the right time for energy efficient retrofits. We need to make it easy for people to make climate-friendly decisions in situations when they are already prepared to make changes.

Behaviour change

Bronwyn Hayward proposed that the term 'behaviour change' could be interpreted to mean 'manipulation', which has negative connotations.

'Behaviour' also applies both to individuals and many other levels of society. Robert Gifford coined the phrase 'both and' to explain that both individuals and society could frame the needed change and that this could add up to something larger than individual actions, leading to significant change.

Connecting climate change to wider social issues

Conversations about climate change have to connect to big social and economic issues, but in New Zealand, we tend to keep the economic system 'off the table' for discussion. In the last few years, there has been a convergence of the economic and psychological views arguing that all that is needed in terms of reform is a focus on individual action/behaviour change. This tends to keep the bigger systemic and collective action issues, including systemic drivers of inequality, off the table.

The debate around climate change has become isolated from the social impacts on vulnerable groups and needs to be integrated more into how all societal activities are undertaken.

The debate around climate change has become isolated from the social impacts on vulnerable groups and needs to be integrated more into how all societal activities are undertaken.

Participant comment

What are the equity issues from economic models and distributional growth models?



We need to create mentoring opportunities so that young people can learn from older people and then pass on what they know to their peers.

The responsibilities falling on young people

Perceptions of young people's concern

Do young people see the coming 'tsunami'? One view is that most do not see it, and those that do struggle to articulate it. Others feel that young people often do not want to know; while others feel huge pressure, feel they don't know where they are going, and feel that everyone should be helping, given that the older generation are largely responsible for the problems.

Engaging young people

There is enormous underutilised potential in high schools—a huge resource we are not using. There are bucket loads of fabulous kids, stunning networks 'just doing it'; a lot of positive action. There is some room for improvement, too: young people tend to undervalue teachers. We need to create mentoring opportunities so that young people can learn from older people and then pass on what they know to their peers. Young people need continued opportunities to broaden their horizons.

Young people are also clever enough to have imaginative ideas. We liked a story of young Australians dramatising the 'elephant in the room'. Creating symbols can enable powerful communication.



Opportunities for innovation

Build New Zealand's international reputation

New Zealand has some advantages over Australia. We are a small country and politicians are accessible, and we have a unicameral political system that simplifies things. Our emissions don't make a global difference, but we have credibility as a broker for doing the altruistic thing because we are part of the globalisation of trade on which our economy depends. We can help others understand the benefits of taking action now. Since we have regular climate events and our economy is sensitive to climate, we get feedback about things that could become more frequent, which may help us frame the needed adaptation more clearly.

Improve institutional capacity

It's not clear that humans are institutionally or socially able to deal with climate change fast enough.

We have the technology to mitigate and adapt to climate change, and the knowledge—in principle. But there is a big problem with social and institutional inertia. Democracy grinds too slowly to avert this huge risk. It is clear that managing risks is a social matter as much as a technical matter.

China may change quickly, with top down direction, but it is hard to change the trajectory of a democracy. Yet, we must retain our society and protect values of freedom and the role of civil society. We can expect our way will yield better solutions in the long run than will an autocracy.

We need social entrepreneurship to transform government; perhaps some 'bulldozer action' is necessary.

Representing different viewpoints and approaches

What is the role of civil society? How can we ensure that disempowered groups such as young people and the 'silent voices' in all generations are represented at decision-making institutions?

Participant comments

We must be strategic, given the challenge, and focus on points of leverage. That means getting leaders to lead. To do that, we must build a constituency—influence others to influence others.

We need to be forward looking at initiatives and mechanisms to facilitate change.

Our emissions don't make a global difference but we have credibility as a broker for doing the altruistic thing because we are part of the globalisation of trade on which our economy depends.

Participant comment

There needs to be a bit more emphasis on understanding inertia to change.

All generations have a responsibility to understand that some will be more disadvantaged than others in society, both within and between generations.

Participant comment

Perhaps we need an Ethics of Responsibility to manage climate change and the uncertainty associated with it.

It is important to have all sectors and levels of government involved in the discussion ...

Participant comments

NZ needs a charismatic leader to present climate change as a genuine, urgent matter that needs strong action.

I felt a strong left-wing bias among [Forum] participants ... If I'm right, then a key question will be 'How do we engage the political right?'

Discuss ethical implications

All generations have a responsibility to understand that some will be more disadvantaged than others in society, both within and between generations. There are generational differences in view and approaches, but dominant voices in the climate-change discussion tend to crowd out other voices. There is also a tension between democracy and inherited or established authority. The established authority is often reluctant to change, lest it lose privilege.

It is important that we explicitly discuss ethical issues. We need to consider the ethical implications not only for future generations but also for people living today. In particular, there are concerns about the global North outsourcing emissions to the South. Ethical questions such as these all need public and political debate.

Include existing networks in the conversation

There is spontaneously emerging leadership from all levels and groups in society. Using these existing networks would enable a more integrated discussion of climate change and what we can do about it.

Bipartisan change

Include all sectors and levels of government

It is important to have all sectors and levels of government involved in the discussion because there are opportunities in climate change policies and actions that have economic value and wider community value through co-benefits such as health.

Work within the existing market system

For climate change, social norms are more persuasive if they have bipartisan support. An example is the United Kingdom's Confederation of Business Industry—business seeing an opportunity to make money out of green business. Most businesses have to see an opportunity to make money before they will change. It is best to work within this system because it is unlikely that the public can be weaned off the market system by 2050, despite the need for huge emissions reductions by then.

Seek independent expert analysis

The ‘tit for tat’ or ‘wedge’ politics of Australia on the carbon tax and the characterisation of climate change policy as ‘shutting down life as we know it’ were generating ongoing conflict and stalemate in advancing policies. The role of the Stern and Garnaut Reviews should not be underestimated in this context since they provide independent and peer-reviewed analysis. This is very useful to politicians as it is publicly open and consulted on, providing a way for differences in power structures to be addressed within existing systems.

Governments do tend to look to experts (like the IPCC), especially those who are good communicators, like Peter Cullen in Australia—a great communicator, with good use of metaphor. The Wentworth group were hugely influential on water policy.

Storytelling

Humans have evolved an ‘old’ brain that functions through storytelling. Storytelling can be very powerful. We need to make better use of storytelling and interact with schools so that children can learn about climate change.

Using storytelling, narratives, images, and film can help improve public understanding of climate change and encourage other autonomous actions to develop.



The role of the Stern and Garnaut Reviews should not be underestimated ... since they provide independent and peer-reviewed analysis.

Participant comment

Where are the stories that show us the impacts and some stories about the opportunities to do things differently?

Participant comment

We need to enhance synergies between science, government, and business.

It is important to find objectives that overlap...

Citizen-politics interface**Align interests**

It is important to find objectives that overlap; to find the space in which we can match citizen interests with the interests of politicians. We know that objectors' voices are heard and we need to make sure others' are too.

Use trusted communicators

Trusted advisers and communicators are important. We need to be alert to the fact that where there is political doubt there is a magnet for science that matches. It is frustrating that all issues become partisan ones. We have such a sense of relief and praise for politicians who can carry a policy over from a previous government and respect the courage entailed.

Represent future generations

We need to consider how the political system can represent the voice of future generations. We need to award smiley faces where credit is due. For example, citizen-spearheaded assessments to build in accountability provide useful merit awards.



Encourage critical thinking

Young people are shunted from pillar to post, ticking boxes and achieving standards. In the employment domain, the jobs available to the under-30-year-olds are often not jobs in which people can express their critical thinking faculties. Training for task is a problem.

We are creating a mismatch in what is taught and available in the education and early-career sectors and what is needed. We are not providing for young people to use their excellent critical-thinking abilities.

We are not providing for young people to use their excellent critical-thinking abilities.





4 | Towards durable decision making



Robust, durable decision making requires political and strategic sustainability as well as what is customarily included within the meaning of sustainability.

The role of science in robust climate policy: How strategic reframing can change the picture

Professor Dave Frame
New Zealand Climate Change Research Institute
Victoria University of Wellington, New Zealand

Robust, durable decision making requires political and strategic sustainability as well as what is customarily included within the meaning of sustainability.

Demarcations and a caveat

Climate policy has several inputs:

- Climate science (which frames but can never specify policy)
- Social science and policy tools (such as estimates of the social costs of carbon)
- Ethical and normative reasoning (which bound policy options)

Within each of these spheres, reasonable minds may disagree, and legitimate and defensible reframing within these areas changes the way the problem looks.

For instance, there is lively, legitimate disagreement among scientists regarding many significant details of climate change, a point that often fails to come across in media portrayals of the issue. Much of that disagreement is expressed within the chapters of the IPCC reports; more still is expressed in conferences and symposia, as well as in the peer-reviewed literature. In this sense, climate science is no different from other healthy research arenas.

The scope for disagreement is even greater in the social sciences where the relationships between climate change and other areas usually play a very strong framing role. This framing has the effect of making different options look more or less obvious or attractive. This is particularly the case when considering the ethical and policy dimensions of climate change.

Pluralism

The public climate change discourse employs a variety of frames or ‘lenses’

People describe the climate change problem using different lenses, which sometimes complement and sometimes are at odds with each other. They are a bit like throwing a series of jigsaw puzzles onto the floor: if you’re asking people to solve five or six jigsaws at once, things get pretty difficult.

In his interesting reflection, *Why We Disagree About Climate Change*⁷⁴, Mike Hulme (2009) proposes the following lenses:

- Climate change as a technological problem
- Climate change as the ‘mother of all public goods problems’
- Climate change as a problem of international justice
- Climate change as a problem of consumerism

Pushing exclusively on any one of these framings will speak to a limited constituency. Because global solutions to climate change require broad coalitions, Hulme argues for approaches more informed by pluralism than have been customary in both academic and popular writings on climate change.

As John Thwaites argued, we need greater levels of bipartisanship to build politically sustainable climate policies. A large part of the challenge is finding ways to broaden the appeal of suites of policies that don’t require everybody to agree about everything.

Contributors to this Forum have pointed out that we know that the deficit model of science—the idea that scientific literacy is the primary barrier—isn’t the real problem with climate change. We know that what is actually at work is a complex array of factors that contextualise climate science for individuals and makes different lenses more or less attractive to them.

Yet this point can be forgotten when it comes to normative dimensions of climate change, where the many subtleties of climate change are often drowned out by heavy reliance on strongly held—but not always widely shared—framings of the human dimensions of the problem. In the minds of pluralists, to rely too strongly on particular normative framings is as much of an error as reliance on the deficit model of science.

Pushing exclusively on any one of these framings will speak to a limited constituency.

A large part of the challenge is finding ways to broaden the appeal of suites of policies that don’t require everybody to agree about everything.

Just as telling people they're scientifically ignorant isn't a good way to make them receptive to science, telling people they're morally deficient isn't a good way to get them to change their minds.

Participant comment

How do we address the problem of equity within countries as well as between countries?

In climate-change discourse, it is usual to consider 'two-agent models'—rich and poor, developed and developing. However, these models fail to recognise rapidly growing and industrialising countries. Considering three agents allows us to examine important strategic implications for climate change policy.

Just as telling people they're scientifically ignorant isn't a good way to make them receptive to science, telling people they're morally deficient isn't a good way to get them to change their minds.

Strategy and climate change^{5 75}

The evidence^{76 77 78 79 80} suggests that climate change is a serious problem but not an existential threat such as an asteroid strike or total war. It isn't an urgent threat like a bomb on a bus or the Cuban missile crisis. It's a long, slow, relentless burn. The real problem with climate change at a global level is that it is difficult to see how any country has sufficient incentives to reduce emissions⁸¹. This means it is the strategic dimensions of climate change that are the really distinctive parts of the problem. And those dimensions are more subtle and interesting than is often supposed^{6 82}.

Three-agent models

In climate-change discourse, it is usual to consider 'two-agent models'^{83 84}—rich and poor, developed and developing. However, these models fail to recognise rapidly growing and industrialising countries. Considering three agents allows us to examine important strategic implications for climate change policy.

Agent 1: The North

The G20 Annex 1 countries: Australia, Canada, France, Germany, Italy, Japan, Russia, United Kingdom, USA.

Agent 2: The GEMs

The G20 emerging market countries (GEMs): Argentina, Brazil, China, India, Indonesia, South Africa, Korea, Mexico, Turkey. GEM countries already account for a larger proportion of global emissions (43 percent) than the North (Figure 7).

The GEMs also accounted for the bulk of global growth in CO₂ emissions in recent years, and are projected to increase their share of emissions in the coming decades⁸⁵. Emissions from these countries are a more significant driver of 21st century climate change than emissions of the other two groups.

5 The section builds on similar modelling work to that presented by Hepburn and Ward (2011).

6 The discussion presented here is a summary and extension of previous work undertaken as part of a symposium and book in honour of the Nobel Prize winning economist Thomas Schelling (Hahn & Ulph, 2012), also summarised as part of the Grantham Research Institute on Climate Change and the Environment's online Working Paper series (Frame & Hepburn, 2011). Interested readers can read these longer pieces in which many of our arguments are expanded upon.

Agent 3: The RoW

The rest of the world (RoW): All other countries.

Three emissions scenarios

We also consider three emissions scenarios and apply the MAGICC climate model⁸⁶ to determine the impact of emissions on Earth's levels of atmospheric CO₂, global mean temperature, and sea levels. We use the RICE 2010 model^{87 88} to evaluate mean economic impacts.

These models are simplifications involving considerable uncertainty. The physical impacts and resulting socio-economic consequences may be much more benign, or considerably worse, than suggested by the modelling here, which is based on best estimates^{7 89}. However, as damages are a function of cumulative emissions, the relative contribution of a country or region to climate-change damages depends only on their relative contribution to cumulative emissions, irrespective of uncertainty or other distributional considerations.

For instance, if the GEMs are responsible for X percent of cumulative emissions, then they are responsible for X percent of climate change damages, regardless of the magnitude and distributional details of those damages. It follows that as contributions to cumulative emissions change over time, so too will the fractional contributions of nations and regions. Specifically, while the North's (cumulative) contributions to climate change damage is currently around 45 percent (den Elzen et al., 2005), under many plausible scenarios this fraction is expected to decline to around 25 percent by the end of the century; the GEM share is expected to grow considerably to potentially around twice that of the North⁹⁰.

This change across time has implications for the institutional management of the problem, since the future of 'historical responsibility' is very different from its past. Institutions structured to deal with the portfolio of cumulative emissions we see today may find themselves ineffective at dealing with the portfolio of emissions our children have to deal with tomorrow.

Emissions from [the GEMs] ... are a more significant driver of 21st century climate change than emissions of the other two groups.

Institutions structured to deal with the portfolio of cumulative emissions we see today may find themselves ineffective at dealing with the portfolio of emissions our children have to deal with tomorrow.

7 This is compounded by current levels of uncertainty: opinions differ as to whether we can yet reasonably assign zero probability to the possibility that some impacts of climate change may prove catastrophic, perhaps even at large scales (see Weitzman, 2009).

Scenarios are always sketches, drawn from the vast range of possible climate mitigation futures.

No one advocates Scenario 1, but it remains a highly likely possibility.

Scenario 2 is broadly what emerges from many of the developing-world proposals ...

Scenario 3 is essentially the position advocated by the USA.

Sound institutional design would anticipate significant political and economic changes, as well as changes in responsibility for the climate-change problem.

Only if patterns of economic development are very different from those seen in the last 20 years, and assumed under standard BAU assumptions, would the strategic picture presented here be radically changed.

Scenarios are always sketches, drawn from the vast range of possible climate mitigation futures. One could argue with the details but these three seem to describe the positions that are on the table.

Scenario 1: No deal

A 'no-deal' scenario, where the recent trends in emissions are projected, based on GDP forecasts broadly consistent with the IPCC Special Report on Emissions Scenarios (SRES) A1FI scenario⁹¹. This scenario fits the present evidence better than the other SRES scenarios.

No one advocates Scenario 1, but it remains a highly likely possibility.

Scenario 2: North leads

A 'North-leads' scenario, in which developed countries commit to reduce emissions by 80 percent of 1990 levels by 2050 (consistent with targets advanced by the European Union and Japan).

Scenario 2 is broadly what emerges from many of the developing-world proposals (such as the Brazilian Proposal).

Scenario 3: North and GEM action

A 'North-and-GEM-action' scenario, where, in addition to Scenario 2 action by the North, GEMs commit to stabilising emissions, except from land-use change, at 2005 levels by 2050. This scenario also assumes that GEMs reduce emissions from deforestation and land-use change by 50 percent of 2005 levels.

Scenario 3 is essentially the position advocated by the USA⁸.

⁸ Refer to Frame and Hepburn (2011) for details.

Scenario results

Table 1 and Figures 7 and 8 summarise the key findings.

Action by the North alone does not prevent dangerous climate change

Building policies today in which the North leads and nothing happens for the foreseeable future in the South leaves us with a problem like what we think we face today. Merely extending the Kyoto Protocol or establishing other responses that focus exclusively on OECD-like groups will thus fail to address the vast majority of the drivers of climate change this century.

Unmitigated climate change is likely to bring significant damages to countries in all three groups, but perhaps especially in the poorest group. This highlights an emerging tension between the interests of those who are gaining most from current fossil fuel-based economic growth—roughly the GEMs—and those who bear most of the risk from such growth—predominantly the RoW. Given expected patterns of emissions growth and development, we expect this ‘South-South’ tension to become increasingly obvious in coming decades.

...[There is] an emerging tension between the interests of those who are gaining most from current fossil fuel-based economic growth—roughly the GEMs—and those who bear most of the risk from such growth—predominantly the RoW.

Table 1 Scenario results from Frame and Hepburn (2011)⁹²

| Variable | Scenario 1 No deal | Scenario 2 North leads | Scenario 3 North and GEMs joint action |
|---|-----------------------|---------------------------|---|
| Average global temperature increase in 2100 (on 1990 levels), °C | 4.6°C | 3.9°C | 2.7°C |
| Atmospheric concentrations of CO ₂ , parts per million (ppm) | 905ppm | 730ppm | 550ppm |
| Sea-level rise in 2100, cm above 1990 levels | 48cm | 41cm | 32cm |
| Economic damages in 2100, % of GDP in GEMs | 3.0% | 2.3% | 1.5% |

It is clear that avoiding dangerous climate change will require regulating CO₂ emissions outside the Annex countries, and it will do so sooner rather than later.

The choices of GEM countries do considerably more to drive global mean temperatures in 2100

Approximately 72 percent of unabated cumulative emissions this century come from outside the North. Thus the vast majority of the BAU problem can only be addressed by regulating non-Annex countries.

Unabated cumulative emissions this century from GEM countries alone under A1FI amount to more than 800Gt C⁹—60 percent more than the available cumulative emissions if we are to contain global mean temperature increase to less than 2°C with 50 percent confidence⁹³.

It is clear that avoiding dangerous climate change will require regulating CO₂ emissions outside the Annex countries, and it will do so sooner rather than later.

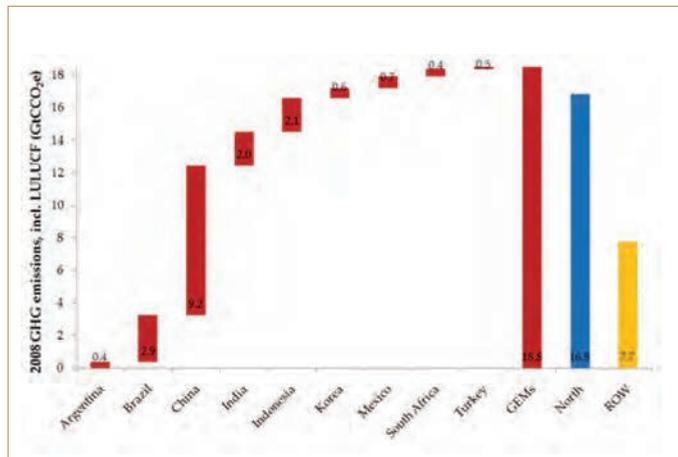


Figure 7 GEMs accounted for more emissions than the North in 2008. From (G20 Annex 1) UNFCCC; (GEMs and Rest of World) World Resources Institute, projections from 2005 data, after Frame and Hepburn (2011)

GEMs can have a substantial impact on climate outcomes

The demographic and economic growth of the GEMs implies a very high BAU emissions trajectory, so the GEMs have the scale to make a substantial material impact on climate outcomes against fossil fuel-intensive BAU baselines. Given their projected GDP losses in 2100 (Figure 8), GEMs also have a financial incentive to address climate change.

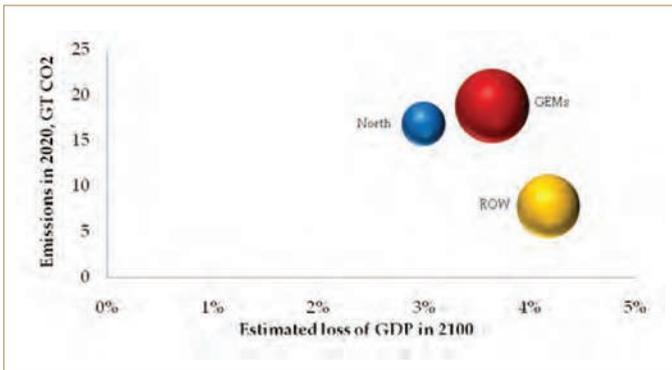


Figure 8 Shares of cumulative emissions under a fossil fuel-intensive future consistent with post-1990 patterns (the IPCC A1FI scenario/the present Scenario 1) from Frame and Hepburn (2011)
(Bubble size proportional to 2008 population)

... GEMs have the scale to make a substantial material impact on climate outcomes ... [and] a financial incentive to address climate change.

Climate change is complex enough that in some domains there are incentives to compete and in others there are reasons to cooperate.

...today's dominant framings ... ignore important strategic dimensions that may either offer new ways out of climate change or which may prove to be even greater barriers to progress than those we knowingly face today.

If we are to be effective communicators and honest brokers of information to a wide range of stakeholders, we should be familiar with and open to multiple framings.

Conclusions

Climate change is complex enough that in some domains there are incentives to compete and in others there are reasons to cooperate.

We need to determine which parts will resolve themselves with a small prod (because of competitive pressure) and which require coordination.

Is the question

- Why has so little been achieved?
- Why has anything been achieved?

As far as global threats go, the strategic dimensions of climate change are its most distinctive aspect. Yet today's dominant framings and, consequently, current institutional design, ignore important strategic dimensions that may either offer new ways out of climate change or which may prove to be even greater barriers to progress than those we knowingly face today.

There is no consensus framing of the integrated dimensions of climate change. There is no consensus (and we shouldn't expect one) about what society should look like, what we should do, what the appropriate discount rate is, or how a government should weigh the interests of its poor versus the interests of people threatened by climate change. We haven't explicitly had these difficult conversations.

Reframings can yield new insights, even if it is sometimes uncomfortable knowledge. Academics have a role in presenting these reframings.

If we are to be effective communicators and honest brokers of information to a wide range of stakeholders, we should be familiar with and open to multiple framings.



The role of future generations in durable decision making

Sacha McMeeking
Ngāi Tahu, New Zealand

Pathways for society—mō tātou, ā, mō kā uri ā muri ake nei

This Forum is a rich and important opportunity to explore the concept of ‘futures’ and the pathways society can pursue to create the inheritance we wish to leave to future generations. I am humbled to be able to participate, and hope that my reflections on the role of vision and shared leadership contribute to the dialogue and proceedings.

Climate change is not ‘too hard’

We’ve heard today, and it has been extensively expounded in other contexts, that climate change is too complex for democracy to embrace and engage with. The characteristics of climate change that ostensibly baffle the democratic machinery are its high uncertainty, resounding complexity, long-term horizon, the multiplicity of responsible and contributory actors, and the contestability of cause and remedies.

However, New Zealand has already made substantial progress on an issue that shares those same characteristics, and that forms the core of my reflections: the Ngāi Tahu Claim (Te Kerēme).

The Ngāi Tahu Claim has metaphorical relevance to our approach to climate change. For Ngāi Tahu, Te Kerēme was a journey that extended over seven generations, across a political landscape that was at times treacherous and always complex, to reach a highly pragmatic point of transition in the Ngāi Tahu Settlement. Sustaining a considered and purposive path of action over seven generations, that effectively unifies a heterogeneous population, is a valuable precedent in the context of climate change, particularly as I do not believe that the conditions and tools that enabled Ngāi Tahu to address a long-term complex issue have yet been achieved for climate change.



The Ngāi Tahu Claim has metaphorical relevance to our approach to climate change.

Sustaining a considered and purposive path of action over seven generations, that effectively unifies a heterogeneous population, is a valuable precedent in the context of climate change ...

The most important tool I believe Ngāi Tahu relied upon was a galvanising vision: *mō tātou, ā, mō kā uri ā muri ake nei* (for us and our children after us). This vision consciously orientates decision makers to the importance of constructing an intentional inheritance for future generations.

Participant comments

How do we begin intergenerational conversation on visions for the future we want?

What is the climate change vision? I'm sure there is more than one— at national, regional, community, and individual levels. Do we need a single shared vision? If so—how do we go about linking those of different groups?

Every part of tribal regeneration and recreation is important and interdependent ... we must rely upon vision and values to provide guidance, prioritise, and reconcile trade-offs.

A simple, shared vision of the future

The most important tool I believe Ngāi Tahu relied upon was a galvanising vision: *mō tātou, ā, mō kā uri ā muri ake nei* (for us and our children after us). This vision consciously orientates decision makers to the importance of constructing an intentional inheritance for future generations. I believe the intentionality of an intergenerational vision provides an unwavering objective and commitment, while also allowing each generation to innovate and improvise how that objective is realised. Ultimately, the vision forms a chain of continuity across generations.

For Ngāi Tahu, the vision, the importance of maintaining intergenerational continuity, and the conscious building of a platform for future generations, were the key grounds on which tribal decisions were made to negotiate and conclude a Settlement with the Crown. Equally, they are the key grounds on which daily decisions are made on tribal regeneration, the respective priority placed on language revitalisation and environmental remediation.

Many of these decisions are complex and contested. For example, the Ngāi Tahu Settlement (\$170 million) amounts to approximately 2 percent of the asset erosion occurring through the colonial period. The decision to accept the Settlement as fair redress was therefore one motivated more by an appreciation of the Settlement as a tool for building the future envisioned for future generations than a rational assessment of compensation for loss.



Similarly, in the approximately 13 years since the Settlement monies were transferred to the iwi authority, more than \$227 million has been invested in tribal development spanning all dimensions of the development journey—every dollar, in principle, should directly enhance the lived reality of current and future generations. However, there is no real way to know and judge the respective merit of recording an ancient waiata as opposed to planting native trees next to a river—every part of tribal regeneration and recreation is important and interdependent. In our decision making we must rely upon vision and values to provide guidance, prioritise, and reconcile trade-offs.

At a deeper level, I believe the vision of *mō tātou, ā, mō kā uri ā muri ake nei* is a product of, and conduit for, ongoing constitutional renewal within the tribal context over the last 100 plus years. Crown vagaries have provoked iwi constitutional contemplation: questioning our role and the expression of the place of iwi histories and values in our ancestral landscapes, the expression of our relationships between our members, and the distribution of authorities and responsibilities across organs within our tribal community.

The fundamentals that I believe have been reaffirmed during these active contemplations are shared values and consensus decision making. Many of the significant decisions the iwi has made over time have been through the institution of *hui*, which are dialogue-driven processes that enable shared understanding to grow and conclusions to be tangibly felt, supporting consensus decision making and the reaffirmation of shared values and vision. *Hui* are a democratic institution that enable communities to reconcile the horizontal relationships between people and participants, with a healthy dose of pragmatism and exploratory thinking.

Applied to climate change, I believe the congealing and empowering nature of a vision could be a useful contributor to domestic and global conversations, serving to bridge (but not obscure) ideologies, competition, and complexity. Equally, I believe some constitutional contemplation could enliven and potentially overcome the apparently intractable debates regarding trade-offs and accountabilities for climate change responses.

...hui ... are dialogue-driven processes that enable shared understanding to grow and conclusions to be tangibly felt, supporting consensus decision making and the reaffirmation of shared values and vision.

...the congealing and empowering nature of a vision could be a useful contributor to domestic and global conversations, serving to bridge (but not obscure) ideologies, competition, and complexity.

...states are no longer in control of what occurs within their territories and are also no longer able to create solutions in isolation for shared problems.

...the iwi mode of dialogue-driven decision making blends well with global trends in collaborative civil governance to give cause for optimism.

Democratic trends

Territoriality is of lesser importance

As discussed during this Forum, many of the tenets of Western democracy are progressively being reconsidered, particularly in light of intractable, trans-border global issues like climate change. The base premise, that democracy occurs within a territorially bounded sovereign state and is part of the social contract between state and citizen, is no longer a clear formula, if it ever truly was.

Territoriality is arguably defined by arbitrary historical factors—who managed to get there and managed to hold on long enough—rather than intelligent design about how communities might exist within a landscape. In the contemporary era, territoriality is even more vexed. Territoriality is, hypothetically, a reasonably tangible formula for defining the bounds of responsibility and authority—the domain of power. However, as the increasingly profound consequences of trans-border issues gain visibility, the notion of locational authority and responsibility are displaced by the reality that causation and attribution are somewhat ethereal—states are no longer in control of what occurs within their territories and are also no longer able to create solutions in isolation for shared problems.

The state no longer has the power to arbitrate between rights holders

The social contract is similarly undergoing metamorphosis as the traditionally vertical relationship between state and citizen. The state guarantees each citizen a lexicon of inalienable rights, but is being clouded by the pressing reality that the state may no longer have the power to make guarantees of this order for two key reasons.

Firstly, the landscape of rights holders has become infinitely more congested; creating competition between rights holders of theoretically equal standing that necessitates some form of arbitration. For example, the limits on the right to freedom of speech have a horizontal relationship with the right to freedom from discrimination, which if brought into direct competition requires a political or judicial resolution. In practice, the process of horizontal reconciliation tends to be political, creating winners and losers, and, more importantly, reflecting value judgements of the day.

Secondly, business is now arguably in a tripartite relationship with citizen and state: business creates the conditions for many of our human rights to be enjoyed, administers our human rights in our employee hours of the day, and has a broad influence on the policy and legislative functions of government.

To the extent that these arguments are correct, that there is a de facto process of constitutional change occurring as the base principles of territoriality and the social contract are morphed by contemporary realities, what does this mean for climate change and is there an iwi insight of value? The simple answer is that the iwi mode of dialogue-driven decision making blends well with global trends in collaborative civil governance to give cause for optimism.

The iwi insight

Iwi have lived through redefinition of their territorial authority in the colonial period and the kin structures of hapū and iwi have a much different character now than in the pre-contact period. My argument is that enduring vision, intentionality in creating an intergenerational legacy, and continuity in core values across the generations, enabled iwi to maintain momentum, direction, and commitment across a truly long-term horizon. From iwi insights (and global trends), three particular lessons appear to emerge.

Institutions can contribute to the emergence of shared moral sensibilities and shared norms

The World Economic Forum, the Clinton Initiative, and the United Nations Global Compact are international institutions that are generating dialogue, building shared understanding, and laying the foundations for shared visions. In my opinion, these institutions operate in a similar way to hui—they fulfil an informal diplomacy role providing the platform later relied upon for decisions to be reached. This form of structured dialogue is important for New Zealand to import through institutions and enabled by technology—the ‘wiki-everything movement’ has a valuable contribution to make.

Of equal importance, these forums gather government, business, and civil society participants to have horizontal conversations across the three key sectors influencing the social contract and all our lived realities. This growing trend of collaborative civil governance, across the three spheres, is critical to our collective future. The 21st century will no doubt be named many things, perhaps one of them will be the age of inter-dependency. Neither government, nor business, nor community organisations can address pressing and intractable problems alone. Multi-stakeholder partnerships and collaboration are the new black. We need to look seriously at what we can do domestically to mirror that institutionalised collaboration and expand the implementation of cross-sector partnerships.

...enduring vision, intentionality in creating an intergenerational legacy, and continuity in core values across the generations enabled iwi to maintain momentum, direction, and commitment across a truly long-term horizon.

Participant comment

We need to develop institutions that can facilitate societal transition and [consider] what sort of institutions they might be (local, national, international).

The 21st century will no doubt be named many things, perhaps one of them will be the age of inter-dependency. Neither government, nor business, nor community organisations can address pressing and intractable problems alone.

...the challenge is to remain open to all options, with lofty aspiration, and not be seduced by the short-termism that can accompany pragmatism.

...we must act together and think in terms of forever if we are to create the future in the image of our grandchildren.

There is no silver bullet

Ngāi Tahu has variously deployed a range of tools from litigation to charm offensives to achieve our desired outcomes, and our success was in their combination. In the context of climate change, there is some appetite for ideologically driven positions on particular interventions—bluntly described as the market will ‘cure all’ or ‘ruin all’ positions. I am not convinced that tools are anything other than practical interventions, with relevance to the extent that they embody a driving vision and values set. I believe that the challenge is to remain open to all options, with lofty aspiration, and not be seduced by the short-termism that can accompany pragmatism.

Mō kā uri

Climate change is perhaps the most devastating injustice that we could leave for future generations; equally, it could be a galvanising force for the conscious creation of a fair inheritance that embodies a global vision and notions of intergenerational equity. Within iwi, there is a reflexive decision-making process that actively questions whether the decision of today contributes to the legacy we are actively creating for future generations—that approach is also growing in prominence in global and local decision-making models. Intergenerationalism is a companion to the rise of collaboration—we must act together and think in terms of forever if we are to create the future in the image of our grandchildren. I am confident that we can, if we try, and if we hold onto a vision: mō tātou, ā, mō kā uri a muri ake nei.

Group dialogue session

Rapporteurs (Ralph Chapman, Amanda Wolf)

Matching what's needed with what's possible

Sequencing and timing are very important. Since actions have to coincide with opportunities available in a particular community, the actions have to be matched to local leadership (fostered by and emerging from the community and then imbued with a sense of the intergenerational continuum).

Rights-based discourses

As Sacha discussed, 'rights' discourses can be unhelpful as they can disempower others by creating competition between conflicting rights and creating more and more rights holders. Asserting one's rights over others could alienate neighbours and create divisions. Moreover, rights themselves do not guarantee durable outcomes.



...actions have to coincide with opportunities available in a particular community.

Transformations at the producer level can be significant compared to what can be done at an individual level.

Technology and investment

Apply incentives at the producer level

Incentives should be applied at the producer level so we can shift some attention upstream. Transformations at the producer level can be significant compared to what can be done at an individual level.

Both positive and negative producer incentives have a role. For example, the 'flatlining' of electricity use in California followed cost-structure changes. Favourable R&D incentives have positive effects.

Determine a carbon price

An entry price on carbon is important, even if it is low, as it could be raised over time like alcohol and tobacco taxes have been. However, a low price signal could prevent an effective response in enough time to make a difference.

Is technology ready

What does it mean to say that some technology is 'ready' to be deployed, or an industrial site is 'ready' for the technology? For example, for carbon capture and storage, the process of 'being ready' is a long one. There is ready for piloting, ready to be rolled out, the power plants ready to integrate the technology, the regulatory framework and incentives for switching ready, the health and safety code ready, a skilled workforce ready to operate it, and ready in that it is cost effective to the bottom line.



Leaving some details to others

Sacha McMeeking reflected on the hui process, where a high-level consensus is reached and the details of putting it into practice are farmed out to others. David Frame evoked the image of multiple puzzles on the floor and the fact that not everyone can deal with every piece, or even a piece, from every puzzle. Instead, a person can gain competence and a localised holistic understanding of those pieces and puzzles they are able to attend to, and can leave the detail of the rest to others.

In neither the hui nor puzzle situation do we deny or minimise the details we do not attend to. We realistically acknowledge what we can do and are thereby empowered to do it.

Changing values

Dave Frame proposed that the discourse be “open to, and respect, neo-liberalism”. There was a challenge to Dave to be aware of the interests of power, wealth, and influence, and the systematic move to remove from the agenda matters such as the public good.

Dave’s view was that he saw a risk that action on climate change could be scuppered by ‘taking on’ neo-liberalism. Others felt that neo-liberalism is a key to the wider set of problems we face, including global financial instability and a growth fixation. However, it is very difficult to persuade people that their values should change.



...action on climate change could be scuppered by ‘taking on’ neo-liberalism.

Credibility is very pertinent in the context of exploring new institutions, how to foster it and ensure it is embedded.

Participant comment

Who presents the long view?

Institutional failure

Following the Christchurch earthquake, the suspension of law and the removal of conventional processes were highly risky. Action needed public participation and consultation. We need extensive public participation and consultation following inclusive procedures in all contexts where the government makes such important decisions on behalf of citizens. Institutions that guarantee these processes are crucial.

Institutions that take the long view are very important, such as the new Commission for Future Generations, in Hungary.

Credibility is very pertinent in the context of exploring new institutions, how to foster it and ensure it is embedded. For a new institution to be better able to make decisions on hard problems, it will need to integrate those decisions with a range of other competing issues, partly to get agreement with those affected and partly due to the inherent nature of the problems we are dealing with being ones that are highly complex, interconnected, and intergenerational.





5 | Reflections on ways forward



This Forum has been blessed with contributions from people with a wide range of backgrounds, experience, expertise, and perspectives ...

Participant comments

I think we need to engage practical engineers

We need more input from spiritual speakers/theologians.

We need to be talking widely to other groups, especially business

We need to consider conservation—our greatest resource.

We need to engage with ecological economists

We need more input from students.

Synthesis

Professor Jonathan Boston Victoria University of Wellington, New Zealand

This Forum has been blessed with contributions from people with a wide range of backgrounds, experience, expertise, and perspectives: politicians, social scientists, biological and physical scientists, journalists, managers, theologians, students, writers, and more. Their emphases and concerns varied, as one might expect.

A variety of emphases and concerns

Local government initiatives

The Mayor of Wellington extended a welcome to Wellington with a focus on local government and the policy initiatives to address climate change being taken by the Wellington City Council.

Emissions targets and the ETS

Hon. Nick Smith, the Minister for the Environment and Climate Change, opened the Forum by highlighting the importance of interdisciplinary approaches, the role of the ETS (and prices) in changing market behaviour (including investment patterns), the nature of the first review of the ETS, and the various complementary measures that the government has in place. He also discussed the Green Growth Advisory Group and the government's 2050 emission-reduction target.

Uncertainty and risk

Martin Manning focused on risks, uncertainties, and surprises in the climate system. He emphasised the non-linear nature of the climate system, the need for risk management, and the application of the precautionary principle.

Path dependence and emissions budgets

David Karoly, described as 'the scariest person in Australia', emphasised the issue of path dependence (due to the immense length of the carbon cycle), the relative success of the Montreal Protocol compared to the Kyoto Protocol, the need to think in terms of cumulative (not annual) emissions over time (and hence GHG budgets over decades), and the issue of per capita allocations of emissions responsibility.

Collective responsibilities and the Pacific context

Sir Paul Reeves reminded us of the importance of collective responsibilities, ethical norms, and principles, and the South Pacific dimension, including New Zealand's responsibilities to the people of the South Pacific.

The much-debated role of scientists

The contributions of Fred Pearce and Brian Fallow (both journalists) and Erik Conway (a science historian), reminded us that:

- fundamentally, the public debate about climate change is not so much about the merits of the science (although this is critical), it is more about values and beliefs
- there are huge challenges for scientists communicating scientific evidence and theories to the public.

They raised a key issue: Should scientists simplify their message to the public, largely ignoring the finer issues of detail and the many ongoing uncertainties, and hence go for dogma over doubt; or should they include all the kinds of caveats, doubts, uncertainties, subtleties and so forth that they would include in scientific journal articles?

Their contributions also raised other important issues, such as: What role should scientists play in public debates on important policy issues? Should they merely stick to facts and data, or should they go beyond the empirical evidence and comment on wider issues? For instance, to what extent, if at all, should they be 'missionaries'? Should they engage in debates on ethical issues? And is it possible, in any event, to remain value free? Further, who should be the guardians of science?

Should science be self-policing (via academies and peer review) or should there be other mechanisms for ensuring the integrity of the scientific endeavour?

...fundamentally, the public debate about climate change is not so much about the merits of the science (although this is critical), it is more about values and beliefs ...

What role should scientists play in public debates on important policy issues?

...have the courage
of your convictions.

Psychology and behaviour change

Robert Gifford highlighted the important issues of social and environmental psychology relevant to climate change mitigation and adaptation and outlined seven dragons of non-sustainability. He then discussed how we might slay these dragons and outlined five approaches, which included an emphasis on the importance of issue framing and messaging (using empowering messages, rather than sacrifice messages, and local messages, rather than global messages), working in interdisciplinary ways, and making the environment a 'now' issue.

The importance of young people and citizenship

Bronwyn Hayward provided information from a major international survey of the attitudes, perceptions, and aspirations of young people and highlighted some of the key themes and tensions that emerge from this.

Political difficulties and bipartisanship

John Thwaites highlighted the political difficulties of addressing climate change and produced his Ten Commandments on how to make a difference, the second of which is to have the courage of your convictions.

The global context

Dave Frame emphasised the huge changes that have occurred in recent decades in the GHG emission paths of different parts of the world (especially the growth of emissions in Asia) and the implications of this for climate negotiations and the wider global policy context.

A shared vision of the future

Sacha McMeeking reminded us of the need for vision and persistence.



Three key themes

Issue framing

Many speakers commented directly or indirectly on the issue and importance of how the challenge of anthropogenic climate change is framed. Framing is important in terms of human psychology, understanding, responses, and also politically. Dave Frame noted that climate change is a long, slow, and relentless issue but that surprises can happen. As such, it has some different characteristics from a natural disaster (such as an earthquake) and requires a very difficult communication strategy and policy responses. The Forum discussed a range of ways of framing issues but no conclusion was drawn on the best ways to frame the issue.

The nature and implications of the human condition

Many speakers touched in various ways on aspects of human psychology and the human condition. It was emphasised that human beings have certain deeply rooted behavioural traits that militate against effective action to address climate change, including:

- a large measure of self-interest
- high private discount rates or myopia
- a tendency to undervalue long-term risks
- a cognitive bias in favour of the status quo, due to loss aversion and the endowment effect
- what Robert Gifford called 'discredence': mistrust, reactance and denial.

It was emphasised that we need to take these (and related traits) seriously, identify the barriers to behavioural change, and focus efforts where they are likely to be most efficacious.

...human beings have certain deeply rooted behavioural traits that militate against effective action to address climate change ...



...climate change raises some very difficult and complex ethical challenges ...

...there is a need for the government to receive independent, authoritative advice ...

The importance of ethics

A number of speakers raised ethical or moral issues and noted that climate change raises some very difficult and complex ethical challenges, not least:

- the nature of our responsibilities to the biosphere and future generations
- the problem of trade-offs between assisting the poor now and focusing on future sustainability
- the issue of global burden sharing (for the costs of mitigation and adaptation)
- the question of the appropriate discount rate in economic analyses of mitigation efforts
- the valuing of non-market goods and services
- the role of scientists in debates of issues of this nature.

On the last of these points, I make three observations: the importance of scientists being in dialogue with philosophers, ethicists, and theologians on the big ethical issues; the importance of scientists contributing to public debates on the ethics of climate change (but doing their homework first); and the importance of recognising the ethical nature of many of the issues that we have to deal with.

Three issues for the future

National emission-reduction targets

The Minister for Climate Change Issues, Hon Dr Nick Smith, took the opportunity afforded by his speech to the Forum to announce the government's decision to confirm its target of a net reduction in New Zealand's GHG emissions of 50 percent by 2050. I observed that the process for deciding long-term policy positions of this nature had been deficient. In particular, there is a need for the government to receive independent, authoritative advice much like the British approach, under which the Climate Change Committee (a high-level, independent body reporting to the government and parliament) provides advice to government on the UK's five-yearly carbon budgets and longer-term emission-reduction targets. Additionally, there is a need to focus on cumulative emissions; it is not sufficient to have a single long-term target for a specific date.

Securing a durable policy framework

Recent developments in various countries, not least New Zealand, have highlighted the difficulties of securing a durable policy framework for climate change, especially mitigation efforts but also adaptation. Amongst other things, this requires a relatively broad, multiparty consensus—but how to achieve this?

There are plainly no easy or simple solutions, and unsurprisingly the Forum generated few new insights. Nevertheless, there is a case, in my view, for creating new institutions, both local and national, to help press the case for policy action, based on expert evidence and high-quality analysis. The British Climate Change Committee provides a good example. Another option would be to extend the mandate of the Parliamentary Commissioner for the Environment. Yet another would be to establish tripartite and/or multiparty mechanisms and forums, such as the Land and Water Forum, designed to help build understanding and consensus amongst key sector groups and the wider society. There is also plainly a case for strong initiatives at the level of sub-national government, by local government, business, and by civil society organisations.

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...surely it will be a pity if a dictatorship is able to achieve what liberal democracies cannot.

Participant comment

We need more information about clean energy initiatives.

The role of China

Will China rescue the world? Dave Frame highlighted that China has recently agreed to invest some US\$750 billion over 10 years in renewable energy and is also investing heavily in other low-carbon technologies and related R&D. Clearly, China sees the potential to become a world leader in clean-tech and green-tech, and secure significant economic (as well as environmental) advantages from such a strategy. Potentially, this could make a decisive difference over the next 10 years to the geo-politics of climate change, as well as the economics of decarbonisation. If so, there potentially will be much to celebrate. But surely it will be a pity if a dictatorship is able to achieve what liberal democracies cannot.



Youth perspectives

Jinty MacTavish **Dunedin, New Zealand**

There are a few thoughts that I'm taking away from this Forum, including:

- strong signs of a solid scientific mandate for change
- empowering community and society
- resilience
- scientists taking more of a back seat
- conversations and keeping them going
- urgency and the need for action now
- messages framed in the positive
- the power of relevant, place-based, meaningful education
- the power of story.

I'd like to share with you the story of the North East Valley Project in Dunedin, which is a community-initiated project that focuses on making their neighbourhood a better place. The great part about the project is that it involves a very diverse group of individuals, organisations, businesses, and groups. A lot of the actions they are engaged in are making their community more sustainable and more resilient, and yet very few people have a focus on climate change or an energy-constrained future. They're just getting on with it because they feel these things are what make a community stronger and happier.

In summary, I think the number one message I took away from the Forum is that we really do need to change the story around climate change. We need to stop talking about sacrifices and start promoting solutions as sensible, practical, mainstream things that people are doing simply because they're good things to do.

...we really do need
to change the story
around climate
change.



Consensus is not possible or desirable when we disagree about fundamentals.

Participant comment

We need to develop transition pathways including incorporation of ecological economics into mainstream economics and displacing the neoclassical approach.

Simon Tegg Wellington, New Zealand

Consensus is not possible or desirable when we disagree about fundamentals. Physical science can work disagreements out like a small pig passing through a python. Eventually, the pig is digested. This simply does not work in social science where ideas about human nature or human destiny underlie debates. The latter also informs climate policy, meaning that efforts to put in place effective global climate policy will most likely fail.

Some accuse the IPCC of stonewalling valid criticism of climate science consensus while at the same time others, particularly those concerned with ice sheet dynamics, are wary of the tendency of consensus-generating processes to tone down conclusions. Climate science has the advantage of a physical basis; long data series; paleoclimate analogs; and, importantly, a diverse, critical, and multidisciplinary community.

Economics, especially economic ideas regarding how growth occurs and the quantity and feasible extraction rates of fossil fuels, has none of these advantages. Orthodox economic growth theory is notorious for not including energy or resource quality in its basic assumptions, while the data on feasible resource extraction are murky at best. These are critical to understanding the degree of expected climate change and the feasibility of responses, but are rarely debated or challenged. Unfortunately, when poor assumptions remain obscured, a 'policy-relevant, not policy prescriptive' consensus across both the physical and socioeconomic spheres is not possible.



Concluding remarks

Professor Dave Frame New Zealand Climate Change Research Institute

'Wicked problems' such as climate change have high stakes, irreducible uncertainties, are complex and multifaceted, and involve many stakeholders with different, and sometimes conflicting, values and perceptions. These features mean that a single approach to climate change is unlikely to be considered wise by a majority of stakeholders.

This Forum has dealt with four aspects of this 'wicked problem', which can inform a way forward:

- 1 Communication about the issue and between interests
- 2 The psychological dimension—the different interests, norms, and values to be understood
- 3 Participation and framing—the issues of agency and overlap with other issues
- 4 Building new institutions

Although these four aspects are crucial for mitigating and adapting to climate change, they are often not obvious in the public discourse on climate change. This discourse tends to be dominated by discussions of 'tonnes of this and that per capita against baseline X'. Broadening the conversation to debate norms, values, participation, ways of communicating, and the role of institutions helps us deal with 'wicked problems' like climate change.



'Wicked problems' such as climate change have high stakes, irreducible uncertainties, are complex and multifaceted, and involve many stakeholders with different ... values and perceptions.

Participant comment

Can participants look forward to receiving ongoing feedback, particularly from the students who attended, and who will be using the Forum experience in their future studies and/or theses?

...institutional innovation is likely to become about as important as the technological and regulatory changes we require. My hope is that the New Zealand Climate Change Research Institute can be one of these new institutions.

Participant comment

Many of these sorts of forums quickly 'disappear off the radar' and are never heard about again. I hope this will not be the case with this one.

To avoid significant and damaging climate change, a range of communities—from village planners through to the UNFCCC—are going to have to become a lot more sophisticated in terms of the structure (and content) of their conversations. This presents an institutional challenge. It is not obvious that today's institutions are well suited for the task, and many thoughtful commentators are contending that institutional innovation is likely to become about as important as the technological and regulatory changes we require.

My hope is that the New Zealand Climate Change Research Institute can be one of these new institutions. As we evolve, we hope to become more able to manage the 'wicked problem' of climate change. We aim to become a place for communication, dialogue, and respectful disagreement; where people can bring their intelligence, passion, and energy, to create genuine engagement aimed at dealing with one of the great problems of our time.

We finish with the words of a great New Zealander, Sir Paul Reeves:

"I would submit, ladies and gentlemen, that we have much to learn about nation building and the challenge of an open society in the way we approach the pressing urgency of climate change.

Physical matter is not inert stuff, foreign to life. It is a mighty organised whole of which we are a part. We belong here and we belong within a whole that we need to take seriously. Our thinking about climate change needs to be wide and expansive."





6 | Biographies and Endnotes



Editors

Judy Lawrence

Judy Lawrence is Adjunct Research Associate at the New Zealand Climate Change Research Institute, Victoria University of Wellington. Her current research interest relates to decision making under uncertainty, dynamic change, and long timeframes associated with climate change induced sea-level rise and increased flood frequency. She is also Director of PS Consulting Ltd, a strategy and policy consultancy. She is a former Chief Executive, Ministry of Women's Affairs; Environmental Strategy Manager, Dairy Research Institute; Director, New Zealand Climate Change Office, Ministry for the Environment; Convenor of the National Science Strategy Committee for Climate Change; and OECD consultant on sustainable development.



Alana Cornforth

Alana Cornforth is a Research Assistant at the New Zealand Climate Change Research Institute, Victoria University of Wellington. She has a BA in English Literature and Art History, and a Masters in Environmental Studies with a thesis on 'Concern for climate change and the knowledge-deficit theory'. Her research interests are the psychology of climate change and climate change adaptation in the Pacific.



Peter Barrett

Peter Barrett is Professor of Geology and Deputy Director of the New Zealand Climate Change Research Institute, Victoria University of Wellington. After graduating from Ohio State University's Institute of Polar Studies in the 1960s he returned to New Zealand to establish the University's Antarctic Research Centre, serving as its Director until 2007. Over three decades, Peter led a series of international drilling projects to core the Antarctic margin for understanding the history of the ice sheet since its inception around 34 million years ago. As a consequence, his work has provided a long-term perspective on the future behaviour of ice sheets in the face of projected future global warming. He has also represented New Zealand on the international Antarctic Committee on Environmental Protection (1998–2003), and in 2006 he was awarded the President's Medal for Outstanding Scientific Achievement in Antarctic Science by the Scientific Committee on Antarctic Research. His current research is directed to providing a soundly based geological perspective on future climate change.



Speakers



Martin Manning

Professor Martin Manning was the inaugural Director of the New Zealand Climate Change Research Institute at Victoria University of Wellington, established to build better interactions between science, policy, and society on climate change issues. From 2002 to 2007, Martin was Director of the Intergovernmental Panel on Climate Change (IPCC) Working Group I Technical Support Unit that produced the Fourth Assessment Report on climate change for governments. He has produced over 50 papers in peer-reviewed science literature and been an author and review editor for several of the major IPCC reports. Martin has worked in several countries but spent most of his life in New Zealand where he led research on GHGs, atmospheric chemistry, and other aspects of climate change science over the last 30 years. In 2008, Martin became an Officer of the New Zealand Order of Merit for his services to climate change science.



David Karoly

Professor David Karoly is an ARC Federation Fellow in the School of Earth Sciences, University of Melbourne and Leader of the Climate Change theme in the Melbourne Sustainable Society Institute. He is an internationally recognised expert in climate change and climate variability, including greenhouse climate change, stratospheric ozone depletion, and interannual climate variations due to El Niño-Southern Oscillation. He was heavily involved in preparing the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), released in 2007, in several different roles. David was Chair of the Premier of Victoria's Climate Change Reference Group during 2008–09. He is a member of the Wentworth Group of Concerned Scientists and of the Australian Government's High Level Coordination Group on Climate Change Science. David joined the School of Earth Sciences in May 2007 as a Federation Fellow funded by the Australian Government. From 2003, he held the Williams Chair in the School of Meteorology at the University of Oklahoma. During 2001–02, he was Professor of Meteorology and Head of the School of Mathematical Sciences at Monash University. From August 1995, he was Director of the Cooperative Research Centre for Southern Hemisphere Meteorology at Monash University until it closed in June 2000.

Sir Paul Reeves

Sir Paul Reeves was Chancellor of the Auckland University of Technology for the past five years, helping to steer the course of a university that is just 10 years old. The affairs of his tribe, Te Ātiawa, took up a lot of his time and he was the deputy chair of a post-settlement entity, the Port Nicholson Block Settlement Trust. Throughout his life, he concerned himself with issues of injustice and inequity both in this country and elsewhere. He had an abiding interest in why people say they are going to do certain things and why, so often, they don't do them. Sir Paul was a pre-eminent New Zealander. He was a man of the church, becoming Anglican Bishop of Waiapu in 1971 and Primate and Archbishop of New Zealand in 1980. He was also the first churchman and first person of Māori descent appointed Governor-General (1985–90). Following the completion of his term as Governor-General, Sir Paul took up a number of national and international positions, including that of Anglican Observer at the United Nations in New York, a position he held for three years. Sir Paul passed away on 14 August 2011, after a lifetime of service to New Zealand.



Erik Conway

Erik Conway is a historian of science and technology residing in Pasadena, CA. He is currently employed by the California Institute of Technology. He studies and documents the history of space exploration, and examines the intersections of space science, Earth science, and technological change. He most recently received the 2009 NASA History award for "pathbreaking contributions to space history ranging from aeronautics to Earth and space sciences", and the 2009 AIAA History Manuscript Award for his fourth book, *Atmospheric Science at NASA: A History*. Erik has been, at various junctures in his life, a nuclear field electronics technician in the US Navy, a student of geomechanics, and a naval officer. He served as damage control assistant, and briefly acting chief engineer, of a tank-landing ship and as an operations planner for a Pacific Fleet amphibious squadron. He had small roles in planning the US withdrawal from Somalia in 1994 as well as the non-combatant evacuation operation from Rwanda. He's a devout fan of Stephen J. Gould's writing on natural history and considers it Gould's fault that he's now a historian of science and technology. Erik began studying the history of climate science in 2002, after receiving a NASA history contract to write *Atmospheric Science at NASA: A History*. Two years later, at an International Commission for the History of Meteorology meeting in Polling, Germany, he met Naomi Oreskes and began a long conversation about the denial machine. He is currently completing a history of robotic Mars exploration.





Fred Pearce

Fred Pearce is a freelance author and journalist based in London. He has reported on environment, science, and development issues from 65 countries over the past 20 years. Trained as a geographer, he has been environment consultant of *New Scientist* magazine since 1992. He writes regularly for the *Guardian* newspaper, and recently published a 12-part investigation of the 'Climategate' emails affair at the University of East Anglia. He is a frequent lecturer, having spoken on all six continents in the past four years, and is a regular contributor to US newspapers and magazines. Fred's books have been translated into at least 16 languages. When *The Rivers Run Dry* was listed among the all-time Top 50 Sustainability Books by the University of Cambridge's Programme for Sustainable Leadership. Other books include *Confessions of an Eco Sinner*; *Earth: Then and Now*; *With Speed and Violence* (on climate change); *Deep Jungle*; and *Peoplequake*.



Brian Fallow

Brian Fallow has been a journalist for 30 years and *The New Zealand Herald's* economics editor since 2000. In that capacity he writes about climate change—what is to be done about it rather than the thing itself.



Robert Gifford

Robert Gifford is an environmental and social psychologist who is Professor of Psychology and Environmental Studies at the University of Victoria. He is a Fellow of the American Psychological Association (APA), the Canadian Psychological Association (CPA), and the Association for Psychological Science, and was given a Career Award from the Environmental Design Research Association. Dr Gifford is the author of about 100 refereed publications and book chapters, and four editions of the textbook *Environmental Psychology: Principles and Practice*. He is the editor of the *Journal of Environmental Psychology*, has served as coordinator of CPA's environmental section, president of APA's Population and Environment Division, and is the immediate past president of the Environmental Psychology division of the International Association of Applied Psychology. He was a co-author of the APA's task force report on climate change, and the article 'Psychology's essential role in climate change'.

Bronwyn Hayward

Dr Bronwyn Hayward is a senior lecturer in political science at the University of Canterbury specialising in children's issues, democracy, and citizenship in environmental change. She is also a researcher with the Sustainable Lifestyles Research Group, a UK research consortium funded by the UK Government (ESRC), Scottish Government, and UK Department of Food and Environment. Between 2008 and February 2011 Bronwyn was a Visiting Fellow with RESOLVE: Centre for Research on Values, Lifestyles and Environmental Change, University of Surrey, UK and the Tyndall Centre for Climate Research (University of East Anglia). Bronwyn is an adviser to the Children and Climate Change project (University of Oslo) and lead author for two country reports for the United Nations Environment Programme's Global Survey of Youth Attitudes to Sustainability (2011). Outside academia, Bronwyn works in television and radio production for children and has been a New Zealand Broadcasting Standards Commissioner. Her forthcoming book with Earthscan publishers (2012) examines children's experiences of democracy and citizenship in a changing environment.



John Thwaites

John Thwaites is a Professorial Fellow, Monash University, and Chair of ClimateWorks Australia and the Monash Sustainability Institute where he is involved in the Institute's Behaviour Change Initiative and the Centre for Water Sensitive Cities. He is a consultant at Maddocks Solicitors providing advice to the firm and its clients on climate change, water, and sustainability. He also chairs the Climate Group Ltd in Australia, the Peter Cullen Water and Environment Trust, and the Australian Centre for the Moving Image. He is also a director of the Australian Green Building Council. John chairs a project with the Brotherhood of St Laurence to develop policies to assist low-income Australians cope with the impact of climate change. He is on the Australian Government's NGO Roundtable on climate change. In 2008–09, John was a special adviser to the Timor-Leste Minister for Infrastructure and helped develop an infrastructure plan for Timor-Leste. John was Deputy Premier of Victoria from 1999 until his retirement in 2007. During this period he was Minister for Health, Minister for Planning, Minister for Environment, Minister for Water, Minister for Victorian Communities, and Victoria's first Minister for Climate Change. In these portfolios he was responsible for major reforms in social policy, health, environment and water. John was a Member of the Victorian Parliament from 1992 to 2007, and was a barrister prior to entering Parliament. He was a Councillor City of South Melbourne (1985–93) and Mayor in 1991–92. He has degrees in law (Honours) and science from Monash University.





Dave Frame

Professor Dave Frame has recently taken up the position of Director of the New Zealand Climate Change Research Institute. He previously held the position of Senior Research Fellow and Deputy Director at the Smith School of Enterprise and the Environment at the University of Oxford, where he remains a Senior Visiting Fellow. Dave is an interdisciplinary scientist with a background in physics, philosophy, economics, and policy. His research experience has been published in the world's leading scientific journals as well as the specialist climate literature. Dave also has real-world policy experience in a core government policy agency, having worked in the New Zealand Treasury's Policy Coordination and Development group prior to moving to Britain. Dave looks at new ways in which advances in climate change research can improve the physical science inputs into climate change policy.



Sacha McMeeking

Sacha McMeeking has recently founded Catalytic, a boutique consultancy providing government relations, strategy, and iwi engagement advice and training. Previously she was the General Manager of Strategy and Influence at Te Runanga o Ngāi Tahu where she held key responsibilities for external relations, brand and reputation management, and engagement with central government. Recently, she has contributed to iwi capability development in infrastructure investment, inter-iwi collaboration in commercial and broader respects, iwi engagement with the ETS, and a range of tribally focused projects. Prior to this role, Sacha focused on academic pursuits. She graduated from the University of Canterbury with a Master of Laws (First Class Honours) and then went on to lecture in the faculty in various fields (constitutional law, Māori legal issues, comparative indigenous rights and international law). During this period, she coordinated iwi advocacy with the United Nations concerning the Foreshore and Seabed Act 2004. Recently, Sacha was the recipient of the Fullbright-Harkness New Zealand Fellowship, which saw her travel to the United States to research corporate social responsibility, with a particular focus on articulating an indigenous paradigm for traditional values-based commercial decision making and exploring the evolving relationship between business, society, and state. Additionally, Sacha has held numerous external board positions and has assisted government as a technical expert on topic-specific advisory groups.

Jonathan Boston

Jonathan Boston is Professor of Public Policy in the School of Government at Victoria University of Wellington. He served as Director of the Institute of Policy Studies during 2008–11. During the course of his academic career he has undertaken research on a wide range of policy issues, including incomes policy, public management, tertiary education, social policy, and climate change. He is the author or editor of 26 books, and more than 200 articles and book chapters.



Jinty MacTavish

Jinty MacTavish is a 25-year-old, newly elected Dunedin City councillor. She is a founding member of Sustainable Dunedin City, an organisation that works to facilitate a positive, secure future for Dunedin City in the face of the challenges posed by climate change and peak oil. She coordinated the first Dunedin Secondary Students' Climate Forum, a youth event that culminated in a vision for the city's future, signed by 3,500 students, being presented to elected members. Her recently completed Masters in Science Communication from the University of Otago focused on climate change education in our secondary schools. Lessons from a Melting Icecap, a film she made to help young people engage with the issue, is being used in over 500 schools nationwide. She played a key role in taking the 350.org movement national in 2009, coordinating the 350.org schools campaign. Having experienced one UNGCCC Conference of the Parties (COP), her hopes for humanity now lie with local government!



Simon Tegg

Simon Tegg is a researcher at the New Zealand Climate Change Research Institute. A pending Masters of Environmental Studies graduate, he is currently engaged in research on the assessment and communication of flood risk under climate change uncertainty. Originally trained in linguistics, he finds himself drawn to multidisciplinary societal problems. These have included the science-policy interface, decision making under complexity, and energy-economic feedback loops. Outside the office, Simon cooks a mean steak.





Sir Lloyd Geering

Lloyd Geering was born in 1918, educated chiefly in Otago, and holds Honours degrees in Mathematics and Old Testament Studies. Ordained as a Presbyterian minister, he served in Kurow, Dunedin, and Wellington. He held Chairs of Old Testament Studies at theological colleges in Brisbane and Dunedin before being appointed as the foundation Professor of Religious Studies at Victoria University of Wellington. He was married to Nancy McKenzie (deceased 1949), to Elaine Parker (deceased 2001), and to Shirley White, and has three children, nine grandchildren (one deceased), and six great-grandchildren. Since his retirement in 1984 he has continued to lecture widely throughout New Zealand and overseas. He was a regular columnist on religious topics: *Auckland Star* (16 years), *New Zealand Listener* (four years). He was awarded an Honorary DD by the University of Otago in 1976, a CBE in the New Year Honours in 1988, and made PCNZM in 2001 (changed to GNZM in 2009). His chief publications have been *God in the New World*, *Resurrection: A Symbol of Hope*, *Faith's New Age*, *Tomorrow's God*, *The World to Come*, *Christianity Without God*, *Wrestling with God—The Story of my Life*, *Coming Back to Earth—From Gods to God to Gaia*, *Such is Life!—A Close Encounter with Ecclesiastes*. He was admitted to the Order of New Zealand in the 2006 New Year Honours List.



Martin Kreft

Following graduation from Auckland University School of Engineering, Martin Kreft worked in the design and construction industries for 10 years in New Zealand and Canada. In 1987 he joined Munich Reinsurance as Engineering Underwriter and progressed through to Property Manager and ultimately Regional Manager for New Zealand in 2003. Martin is a member of the Institution of Professional Engineering New Zealand, the Australian and New Zealand Institute of Insurance and Finance, and a Board Member of the Insurance Council of New Zealand.

Ralph Chapman

Dr Ralph Chapman directs the Graduate Programme in Environmental Studies at Victoria University of Wellington. An environmental economist, he's worked on energy, transport, urban design, and climate change. He's also worked with the New Zealand Ministry for the Environment, the New Zealand Treasury, the British Treasury in Whitehall, the OECD, in the Beehive, and as a negotiator for New Zealand of the Kyoto Protocol. Ralph has a first in engineering, a Masters in public policy, and a PhD in economics.



Judy Lawrence

See Editors section.

Amanda Wolf

Dr Amanda Wolf is Director, Graduate Research Programmes in the School of Government, Victoria University of Wellington. She holds degrees in philosophy and policy (global environmental negotiations). She currently researches on experimentation and learning from practice in complex policy contexts, subjectivity and 'common sense' in research and policy analysis, and persuasion in policy. Amanda's longstanding interest in the interfaces between public perceptions, attitudes, values, and experiences on the one hand and policy and regulation on the other has stoked her fascination with innovative uses of social science—process and product—with applications to environmental, social, and food policy topics.



Facilitators



Morgan Williams (Climate Futures Forum Chair)

Dr Morgan Williams completed 10 years as New Zealand's Parliamentary Commissioner for the Environment (PCE) in March 2007. He had held Adjunct Professor roles at the Universities of Canterbury and Queensland, for eight years. In April 2004, Lincoln University awarded Morgan an honorary doctorate in Natural Resources. Morgan is a trustee of Leadership NZ, WWF NZ, the National Energy Research Institute, and chair of a new wind-power company aimed at community-based wind farm development. Morgan has chaired a review of eight long-term research portfolios for New Zealand's Foundation for Research, Science and Technology, written a 'think piece' on the future evolution of the Waitakere Ranges and associated city and urban farming landscapes in Auckland, chaired a national biosecurity committee and recently has contributed to a global Frontiers of Sustainable Development think tank in Europe and a Food Futures Forum in Iceland.



Bob Frame

Dr Bob Frame helps people imagine what kinds of futures might lie ahead and then find ways to translate this foresight into good decision-making processes. He has worked closely with government agencies. After training in Scotland as an engineer and research physicist, he had diplomatic postings in China and India and was then Director (Asia and Americas) for DATS, British Council in the UK, and now, once again, does research, which he calls transdisciplinary. Bob is Principal Scientist (Sustainability and Society) at Manaaki Whenua Landcare Research, based in Lincoln.



Karen Cronin

Dr Karen Cronin has a background in social research, environmental management, and communication. She has held management positions in local and central government, and an international NGO. Karen has worked as a consultant in the New Zealand science sector and has lectured on 'science, technology and society' (STS) and environmental management. Her research interests include: risk management, science policy and governance, deliberative dialogue, sustainability science and transdisciplinary research. Karen leads the STS programme at ESR research institute and currently manages a Foundation for Research, Science and Technology project using upstream engagement methods around future food technologies and an ESR project on innovative models for risk decision making. She was the co-founder and inaugural convenor of the Asia Pacific STS Network in 2008–09. She co-organised a New Zealand conference on Sustainability Science and Climate Change in March 2010 and the Degrees of Possibility workshop in December 2010, on establishing a New Zealand social science research agenda for climate change.

Climate change and society's challenge

Martin Manning

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Sir Paul Reeves

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Communication between the science community and society

Erik Conway

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