CLIMATE CHANGE

An illustrated public lecture given by Robert Anderson PhD

One of three presentations organised as an annual public service
by the United Nations Association, Tauranga, New Zealand
(35 pages - 64 slides)

This lecture was first presented in 2006. Sadly, Bob died in December 2008.

Some facts and figures may have changed since the lectures were presented. Keep up to date by accessing the Internet.

N.B. Climate change and global warming are used interchangeably in media reports.

More recent news:

People in Bolivia, Ecuador and Peru depend on the Andes' glaciers for drinking water, agriculture and electricity generation. In 'Slippery Slopes' (screened August 2009) Nature Inc.[1] found that many of the glaciers are melting so fast scientists predict most could disappear inside 25 years. One scientist suggested one of the glaciers could disappear in 2010, so little of it is left.

A Friends of the Earth report – 'Highstakes - climate change, the Himalayas, Asia and Australia' - examines scientific research on the Himalayan melt: "The Greater Himalayas are warming at two-to-four times the global average rate. If global warming continues along the current path, the Himalayan glaciers will melt at an accelerating rate until they eventually disappear." The melting threatens flooding and, long-term, the loss drinking water. Rivers such as the Ganges in India and the Yellow River in China will have no dry season flow and the people of the river basins will lose water security.[2]

Research, published in the journal *Geophysical Research Letters*, shows that Pine Island Glacier in West Antarctica is shrinking rapidly. It is losing ice four times as fast as it was a decade ago and the ice is now thinning much further inland. If this rate continues, scientists estimate that the main section of the glacier will have disappeared in just 100 years. This is six times sooner than was previously thought.

Scientists have tracked the glacier's development using continuous satellite measurements over the last fifteen years. Many believe that its accelerated thinning is perhaps the greatest imbalance in the cryosphere today. The Glacier contains enough ice to almost double the estimated sea level rise for the 21st century arrived at by the Intergovernmental Panel on Climate Change, the IPCC. Led by Professor Duncan Wingham of University College, London, the research was funded by the UK Natural Environment Research Council.[3]

N.B. Pine Island Glacier flows west-northwest along the south side of the Hudson Mountains into Pine Island Bay, in the Amundsen Sea, West Antarctica. It is a 5400 square kilometre region - roughly twice the size of Scotland - and the area it drains comprises about ten percent of the West Antarctic Ice Sheet. Satellite measurements show that the Glacier's Basin has a greater net contribution of ice to the sea than any other ice drainage basin in the world and this has increased with the accelerated thinning.

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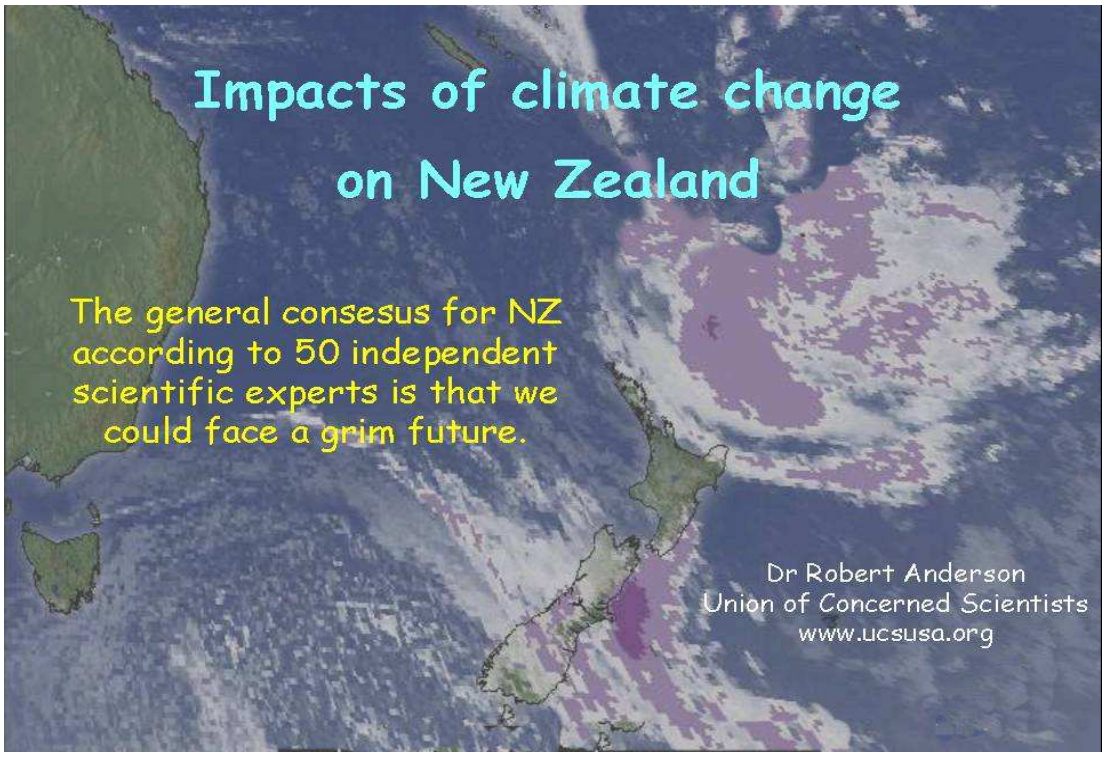
[1] Part 1 http://www.youtube.com/watch?v=MkuMfIErQc8, Part 2 http://www.youtube.com/watch?v=hc4oNrJ1_XY.
[2] http://www.foe.org.au/climate-justice/media/news-items/2009/the-big-melt-climate-justice-tour.
[3] University of Leeds, 14 August 2009, 'Antarctic Glacier Thinning At Alarming Rate.' ScienceDaily www.sciencedaily.com-/releases/2009/08/090814100105.htm.

Slide 1



Climate change constitutes perhaps the greatest threat to civilisation that we have ever faced. It is the most compelling story any reporter could hope to work on. Yet to date the news media have given it too little and often sceptical attention despite the increasing severity of storms and the fact that the heating effects of the planet are becoming obvious. Even schoolchildren now study climate and storms and, I must say, we can get some pretty witty answers.

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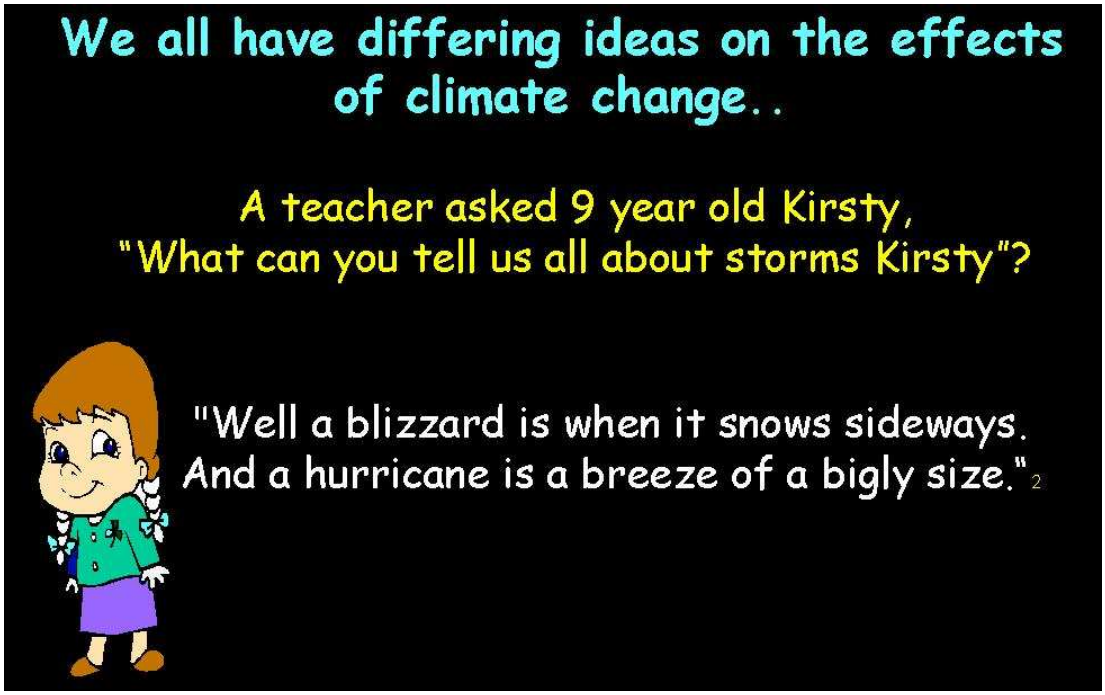

Humour aside, let us not forget that climate change is a *critical* issue. Each day brings more evidence that what we face.

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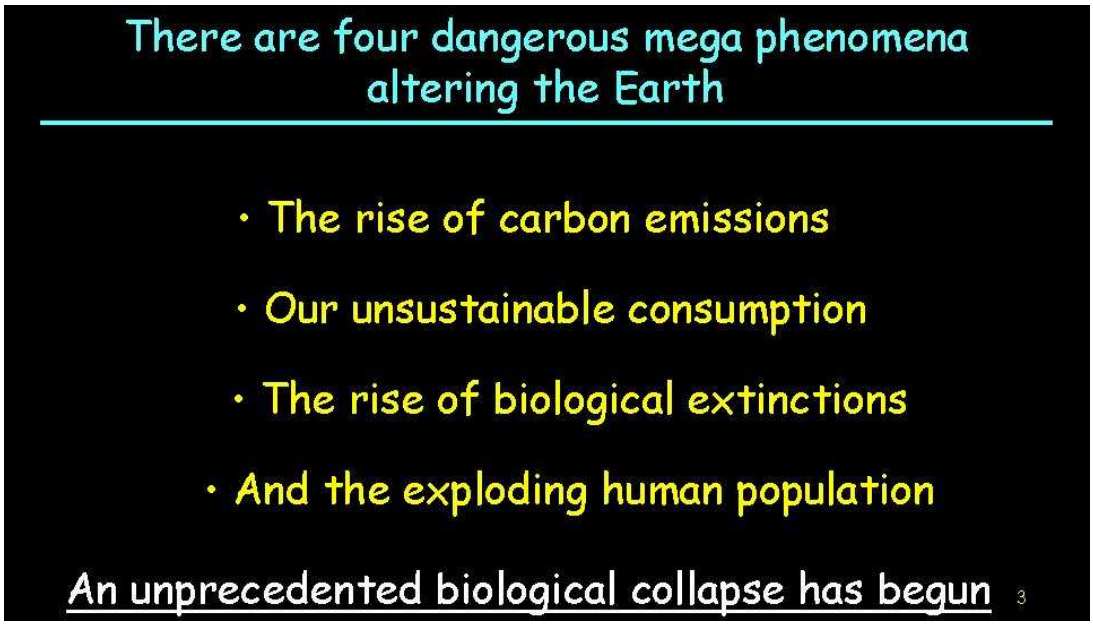

In short, I am not being melodramatic when I say…

Slide 4

If we do not do something about it, our legacy will be a world that is virtually uninhabitable for future generations. Like Al Gore and many scientists have said, I do not think we should give up fighting to stop this. There are lots of things we can do.

Important is creating a 'critical mass' of opinion, the voice of which will be heard above corporate- and industry-sponsored hype and agendas.

As I said, the news media largely treats the issue with kid gloves or remains silent. Not because climate change is a bad story - on the contrary, conflict is the lifeblood of journalism, and the climate change issue is teeming with conflict - so why the lack of media attention to one of the biggest stories of this century?

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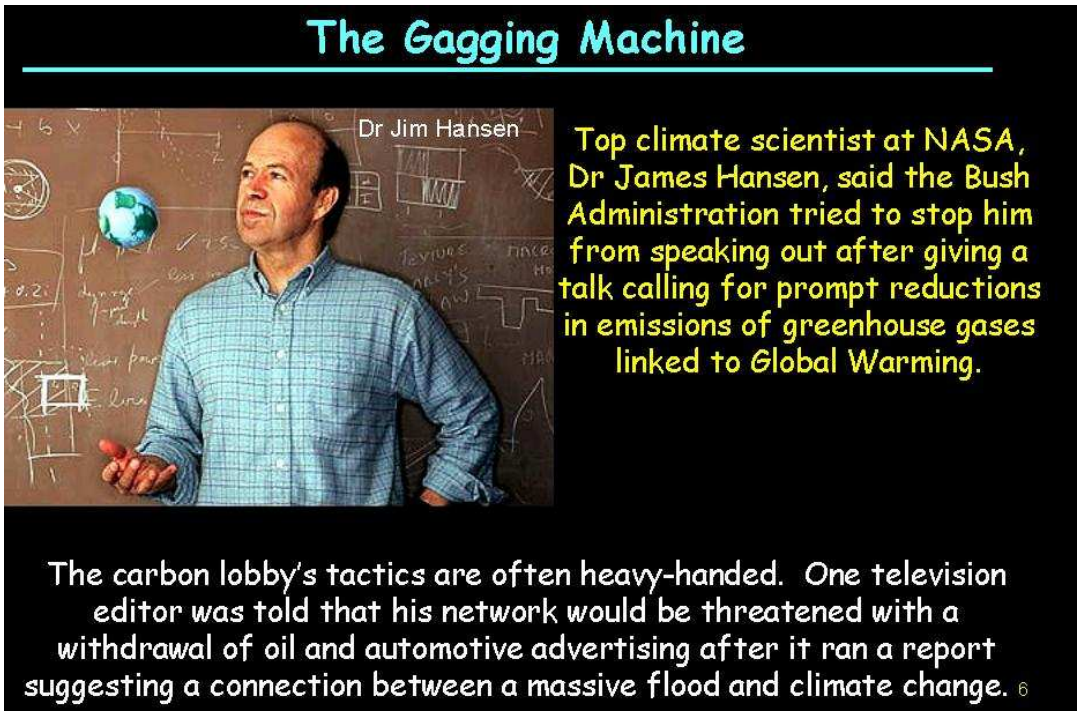
Slide 6



Leaked internal papers from the coal lobby said the purpose of their campaign was, and I quote:
"To reposition global warming as theory (not fact), with an emphasis on targeting older, less educated males, and younger, low-income women in districts that received their electricity from coal."

These arguments have little to do with science, and everything to do with politics and profits. A prime tactic of the fossil fuel lobby is focused on a clever manipulation of the ethics of journalistic balance. Any time reporters write stories about climate change, industry-funded sceptics demand equal time in the name of balance. As a result, the press accord the same weight to industry-funded sceptics as to mainstream scientists, creating confusion in the public mind.

Even today, there are people who are unsure of whether climate change or global warming is real.

Journalistic balance comes into play when a story involves opinion. Should we invade Iran? Should we promote single sex schools? For such issues, an ethical journalist is obligated to give each competing view roughly equivalent space. But when the subject is a matter of *fact*, the concept of balance is irrelevant.

What we know about Earth's climate comes from the largest and most rigorously peer-reviewed scientific collaboration in history - the findings of the more than 2000 scientists from 100 countries reporting to the United Nations as the Intergovernmental Panel on Climate Change (IPCC).

Dr James Baker is the former administrator of the US National Oceanic and Atmospheric Administration. He echoed many scientists when he said: *"There's a better scientific consensus on this than on any other issue I know - except maybe Newton's law of gravity."*

The British Government's chief scientist, Sir David King, warned that climate change is the most serious threat facing our planet.

But, obviously, there are those willing to avoid the truth for more self-indulgent reasons.

Slide 7

So what is happening?

Why the panic?

Let us do a quick check here.

Slide 8

WHY?

Globally, air, water, land and ocean ecosystems are collapsing.

- Seas are overfished and polluted by toxic waste [including nuclear waste]. Areas of 160,000 Km^2 are dead: no coral, no fish, nothing.

- Worldwide, water is becoming scarce and/or poisoned. PCB's and other noxious chemicals pollute lakes and rivers.

- Forests are vanishing: 1.5 acres of rainforest lost every second. One hectare may contain over 750 types of trees and 1500 plant species.

- Topsoils are being eroded: agricultural land overworked and exhausted to squeeze greater production profits without thought for sustainability. 8

Slide 9

In 2004, we pumped about 15,000,000,000,000 pounds of carbon in the form of heat-trapping CO_2 into the atmosphere. Likewise, millions of tons of other greenhouse gases. This is about 40 times the combined total weight of the entire world population.

Every gallon of diesel releases 11 Kg of CO_2

Unnecessary, unsustainable hyperconsumerism and over consumption are annually converting 57 trillion pounds of materials into garbage. 9

What effect does this have on our planet - Earth?

Slide 10

By anybody's book, this is a frightening scenario. And as UK *Guardian* journalist, George Monbiot, said, oil giants such as ExxonMobil give money to scores of organisations to promote claims that climate change is inconclusive. This strategy has set back action the world could have taken on climate change by a decade.

Let us here just revise exactly what the "Greenhouse" effect is for those not so familiar with the science.

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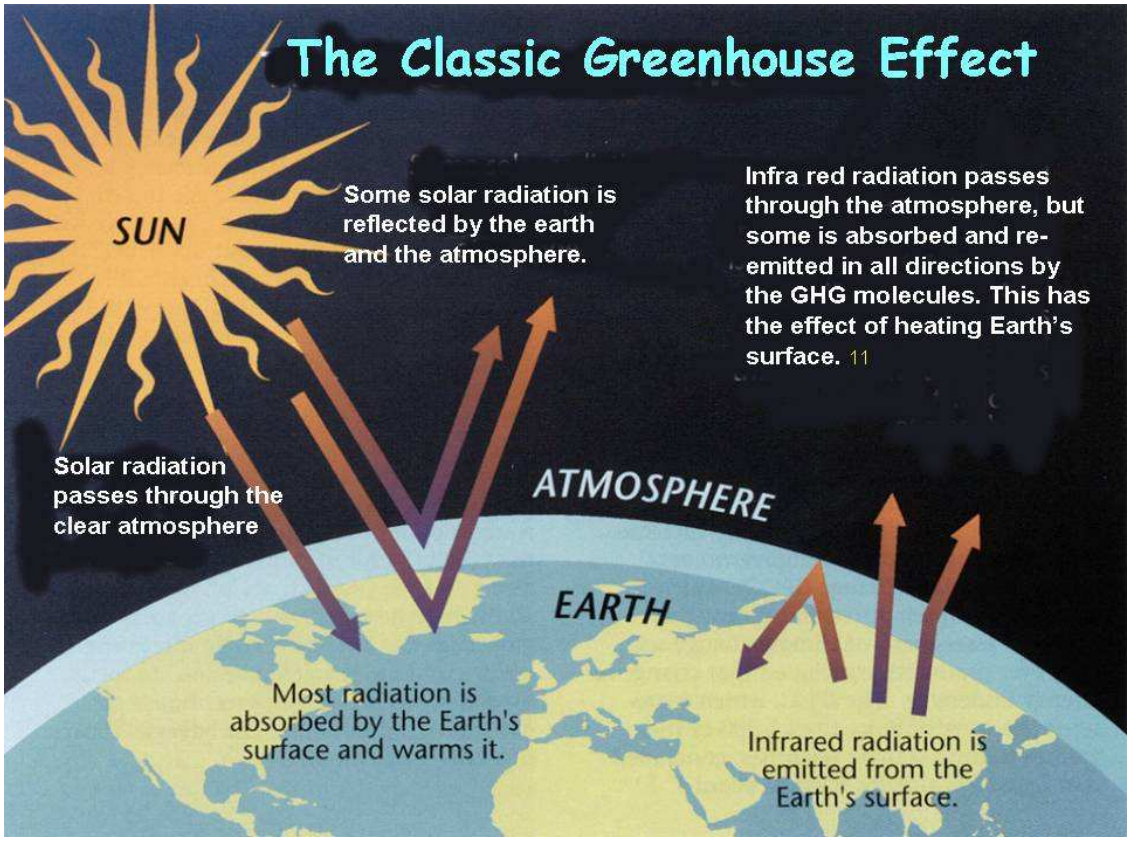

What is not mentioned in the slide is water vapour in the form of clouds. Water vapour is also a powerful reflector of the sun's energy.

So who is generating the most greenhouse gases?

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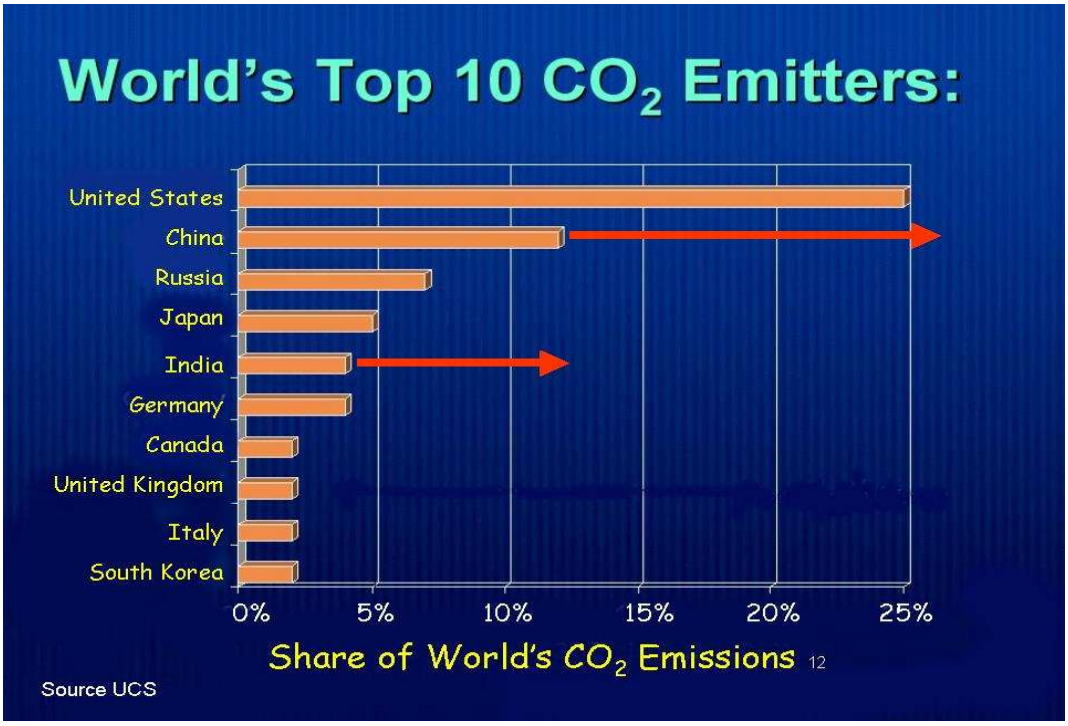

In fact, China has now overtaken the US - not surprising as they reportedly continue to build two coal-fired power stations every week. Although well below the US and China, India's emissions are also increasing rapidly.

Most people can understand the basic idea of climate change once it is explained to them; dealing with it will be costly and an immense task. And the decline in oil and gas supplies will increase the difficulties. So what do we know for sure?

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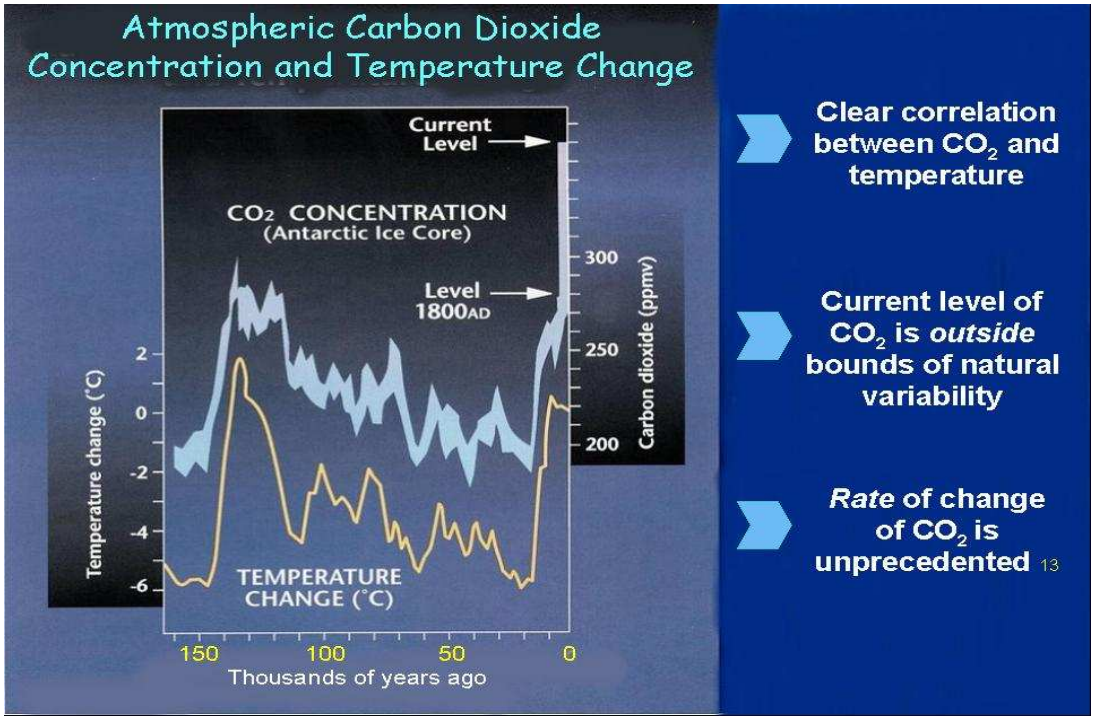

Cores bored into the oldest ice in Antarctica revealed that the rapid rise in Greenhouse Gases over the last century is unprecedented in the last 800,000 years. Comparing air bubbles trapped in this ice over hundreds of thousands of years clearly shows the way we are changing the composition of Earth's atmosphere *right now - in a way it has never been changed before*.

In fact, measuring CO_2 concentrations in ancient Antarctic ice cores is the most convincing evidence of climate change due to CO_2.

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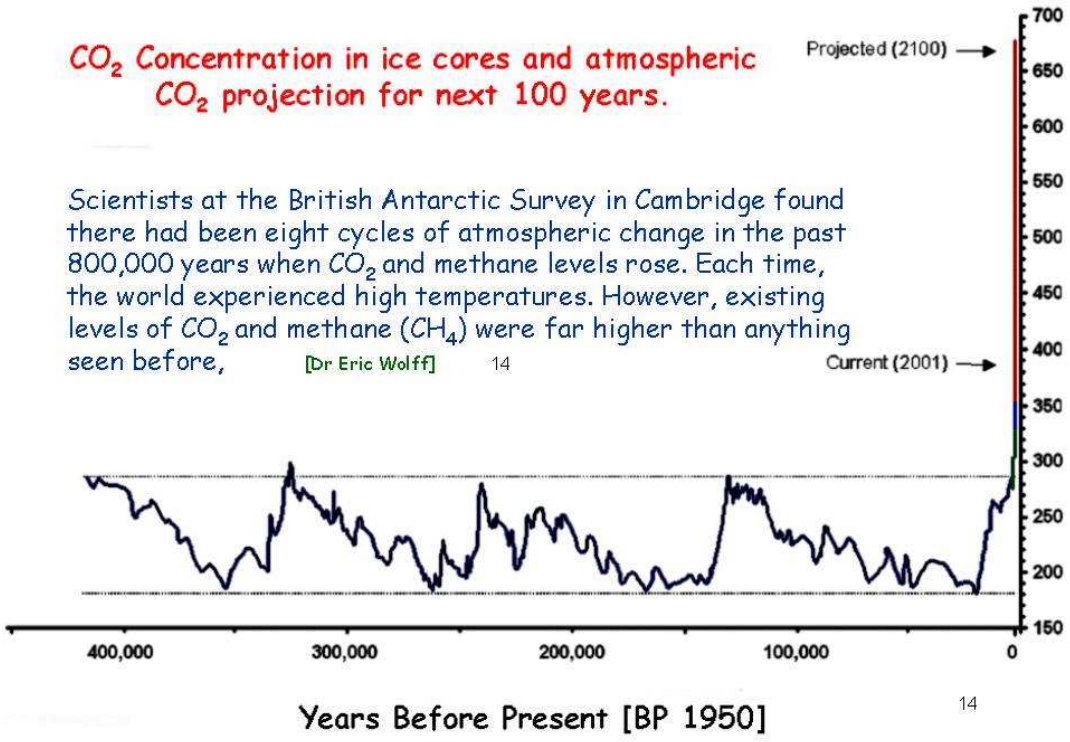

The cores showed that CO_2 has always been between 180 and 300 parts per million (ppm) during those 800,000 years. *Right now* it is *380 ppm and rising*. Methane was previously never higher than 750 parts per billion (ppb). *Right now* it has climbed *to 1780 ppb*.

What are the overall impacts of this heating process?

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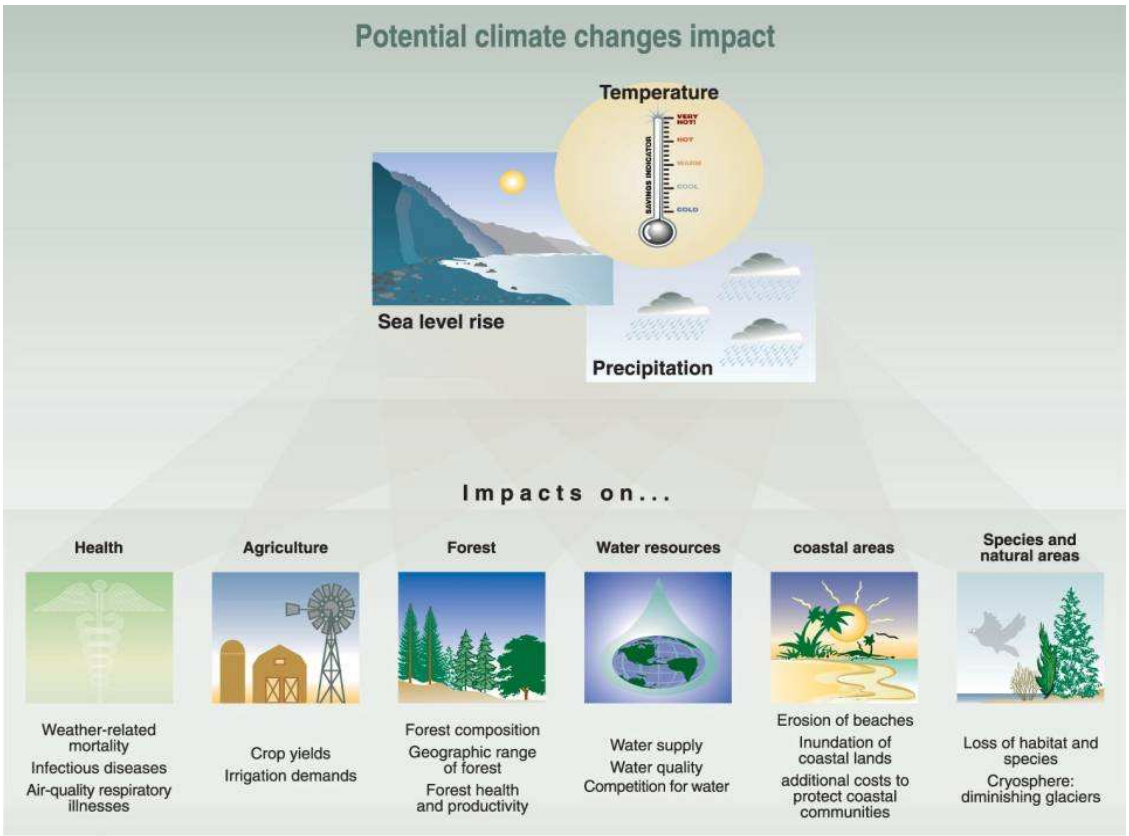

It is important to look at the link between climate change and its effects. One example is the loss in biodiversity.

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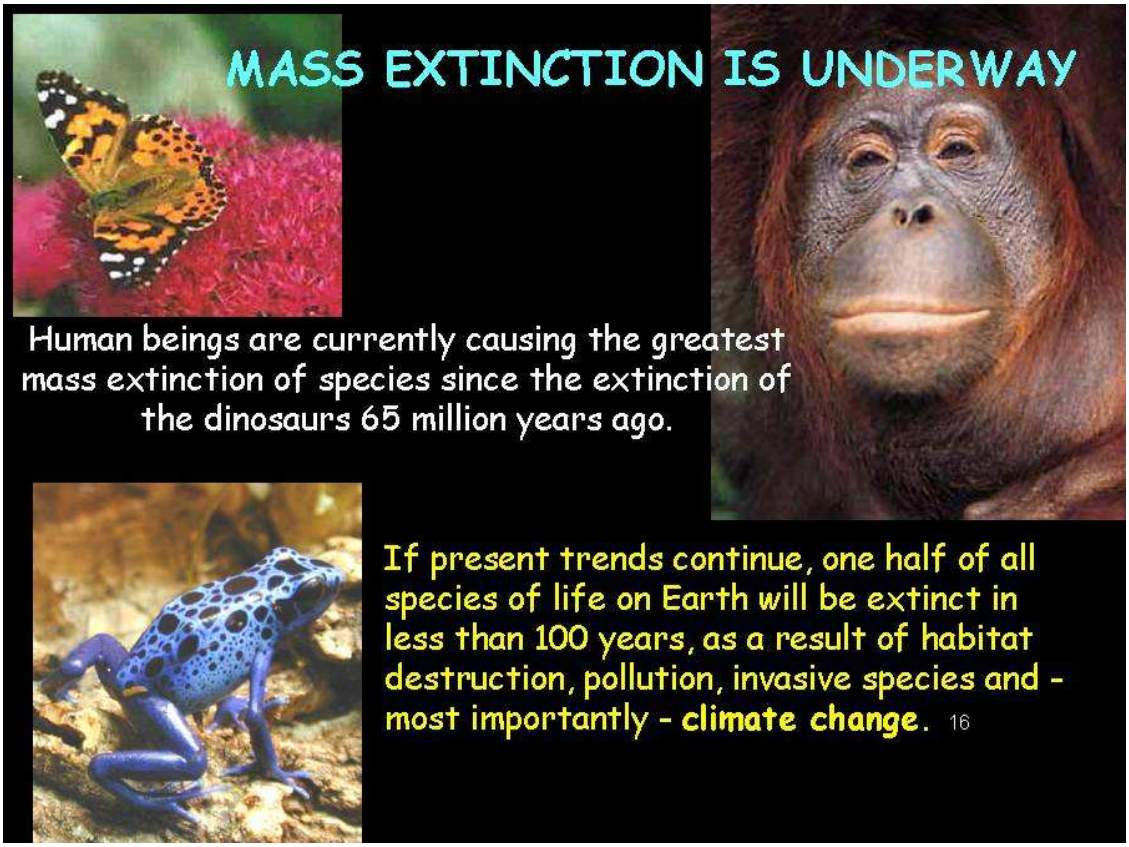


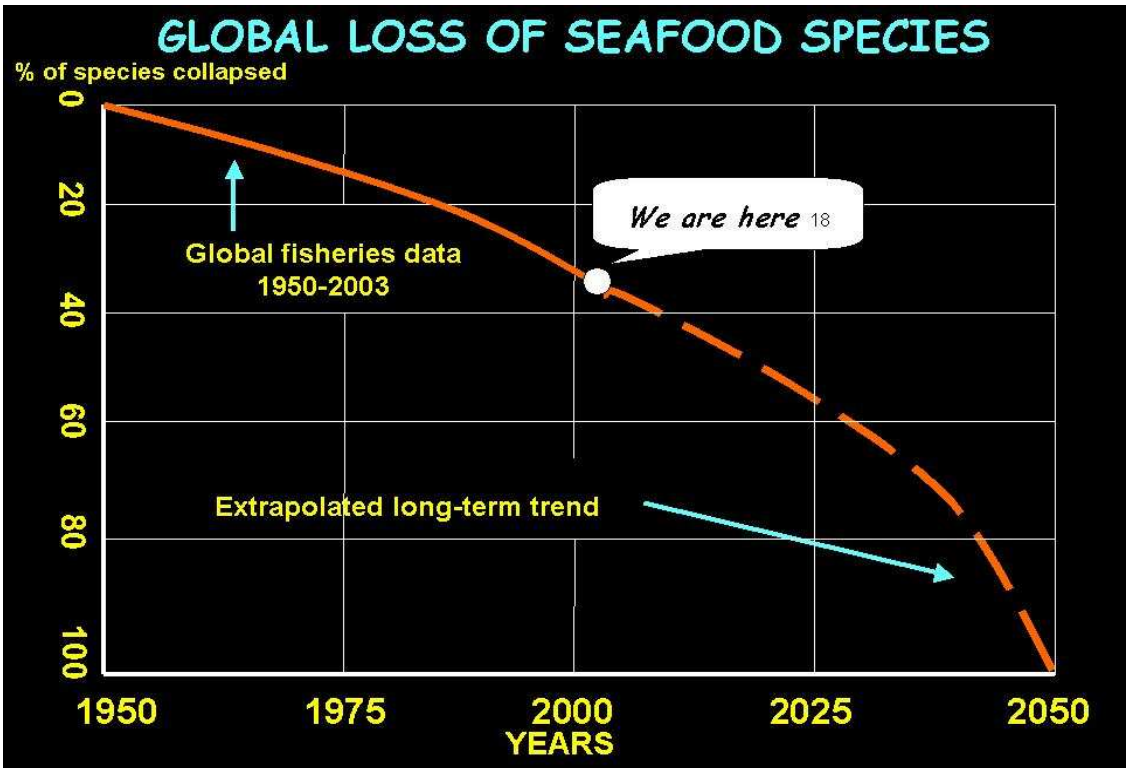
Another example: we are scooping *billions* of tons of fish from the sea every year . . . and we are simply not allowing time for species to recover. Let us look at the fishing of the oceans.

Slide 17

In looking at the global fish harvest, we should remember that fishing uses *nearly eight times the energy that agriculture uses* in its tasks.

The results of over fishing are clearly shown in the following graph:

Slide 18



Rather than stop fishing altogether, the European Union and the British government are funding a project that converts the UK fishing fleets to biofuels. This looks like a smart move, yes? Not really.

A substantial amount of biofuel supplies come from soybeans grown in Argentina. The push to grow more soybeans - as a monoculture crop - is the main driver behind deforestation in the Chaco and Yungas forests. It is a disaster for biodiversity, for the climate, and for local communities. Soybean plantations are linked to large-scale pesticide poisoning, the displacement of tens of thousands of indigenous people, and the rising poverty rates in Argentina.

So much for the oceans. What about our forests? Millions of acres of trees are being destroyed worldwide. The daily fell rate is huge. Earth's forests are in *very* serious decline.

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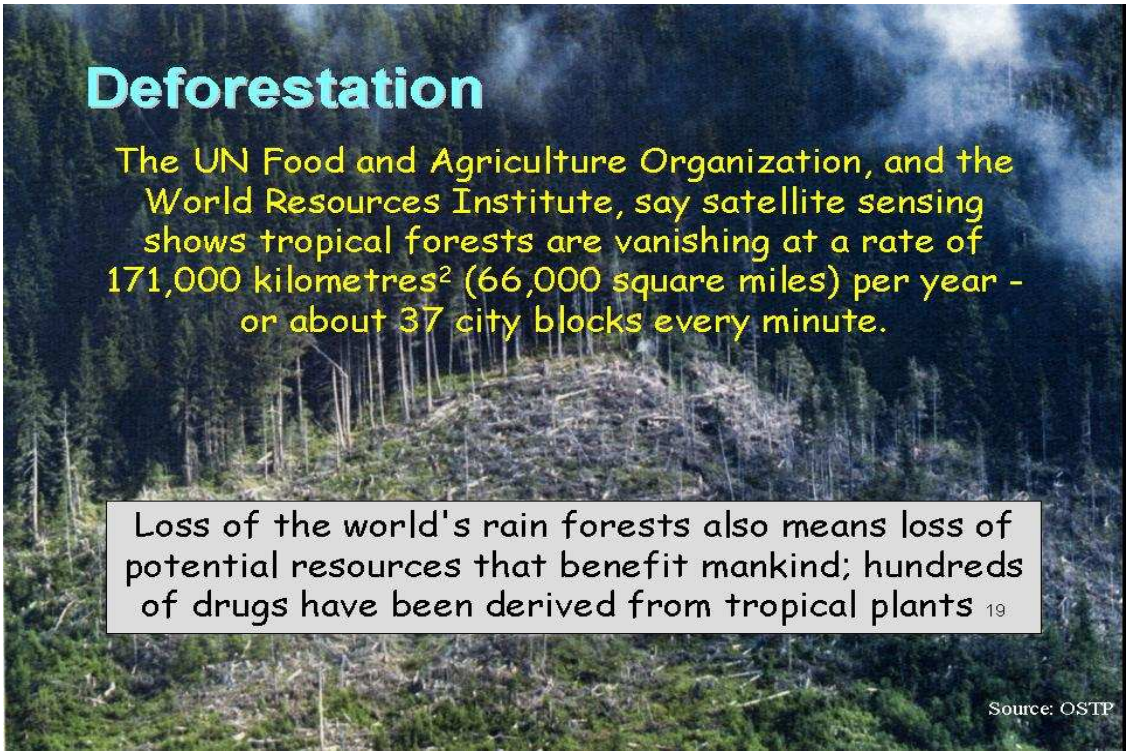

With the destruction of these forests, we lose countless valuable medicine plants, the extinction of species, some destroyed before they are even discovered. And all this beside the loss of their *beneficial* effect on climate.

A further concerning factor of climate change is the rise in sea levels. For an island nation such as New Zealand, this will have very serious consequences.

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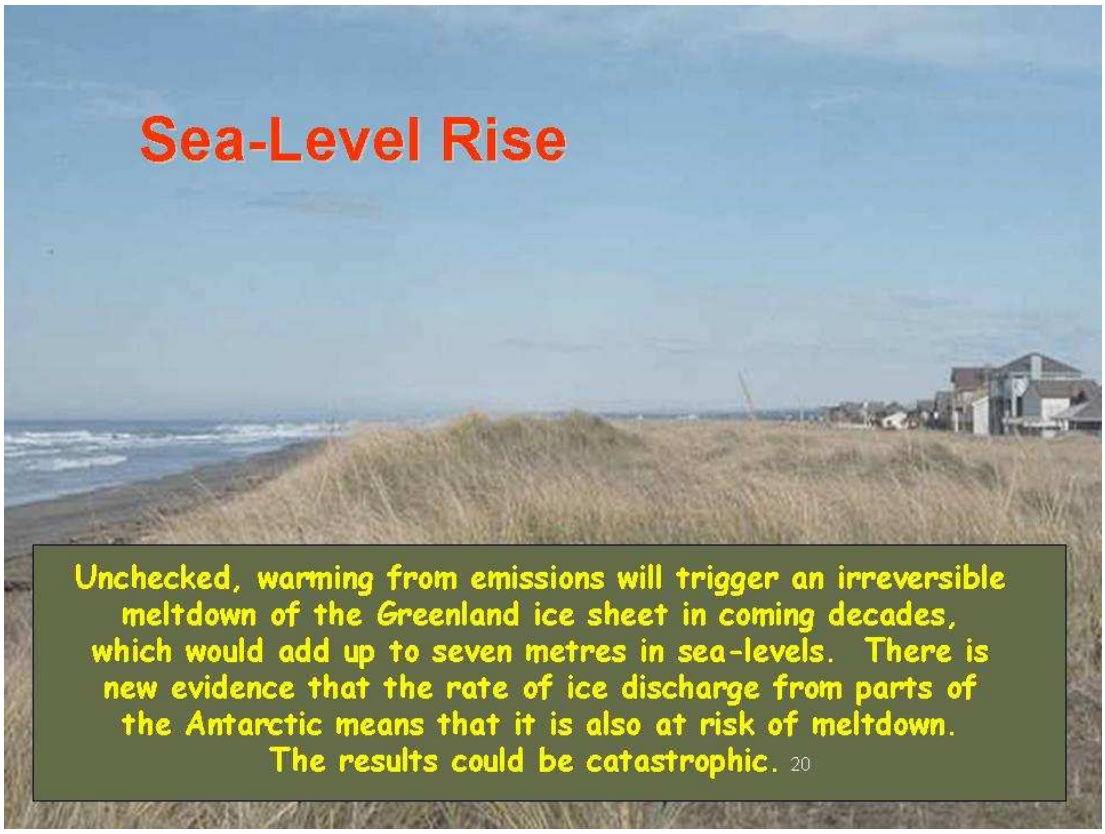

With rises in sea levels will come greater coastal erosion. Coastal erosion is already a major problem in many areas of the world, including some parts of New Zealand.

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So, without being over dramatic, we have to act to curtail this planetary die-off if we are to leave a world fit for future generations to inhabit. Already...

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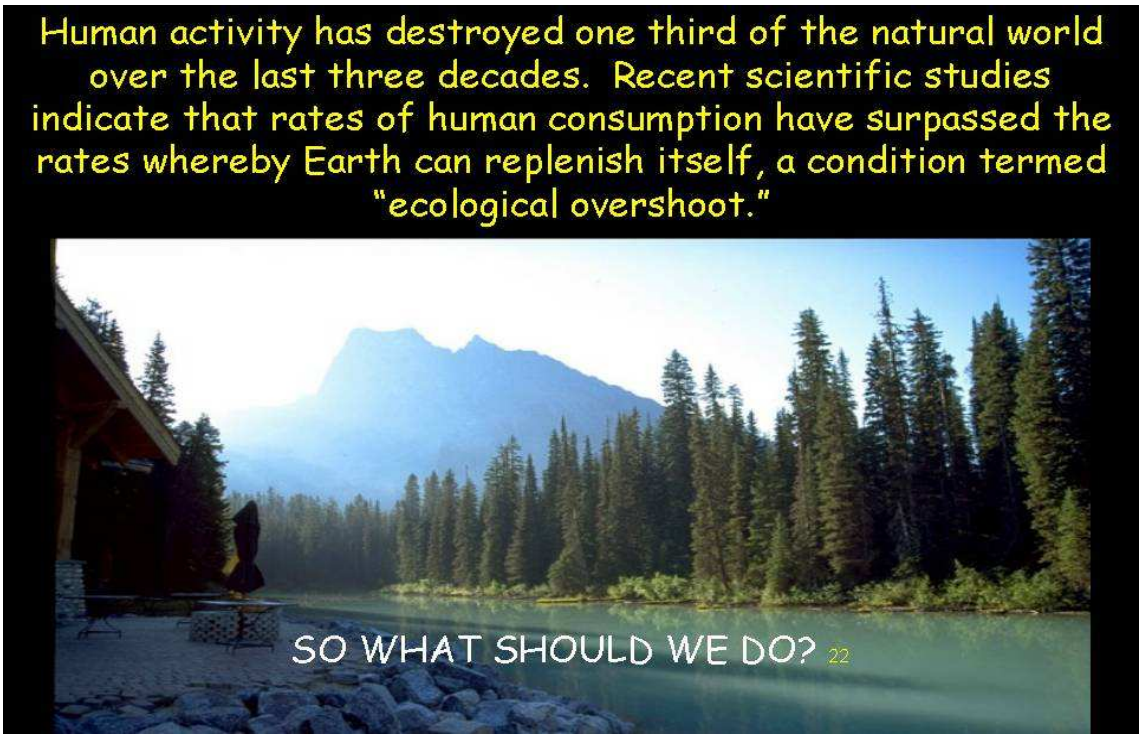

Obviously, we MUST reduce the ecological footprint we make on the planet.

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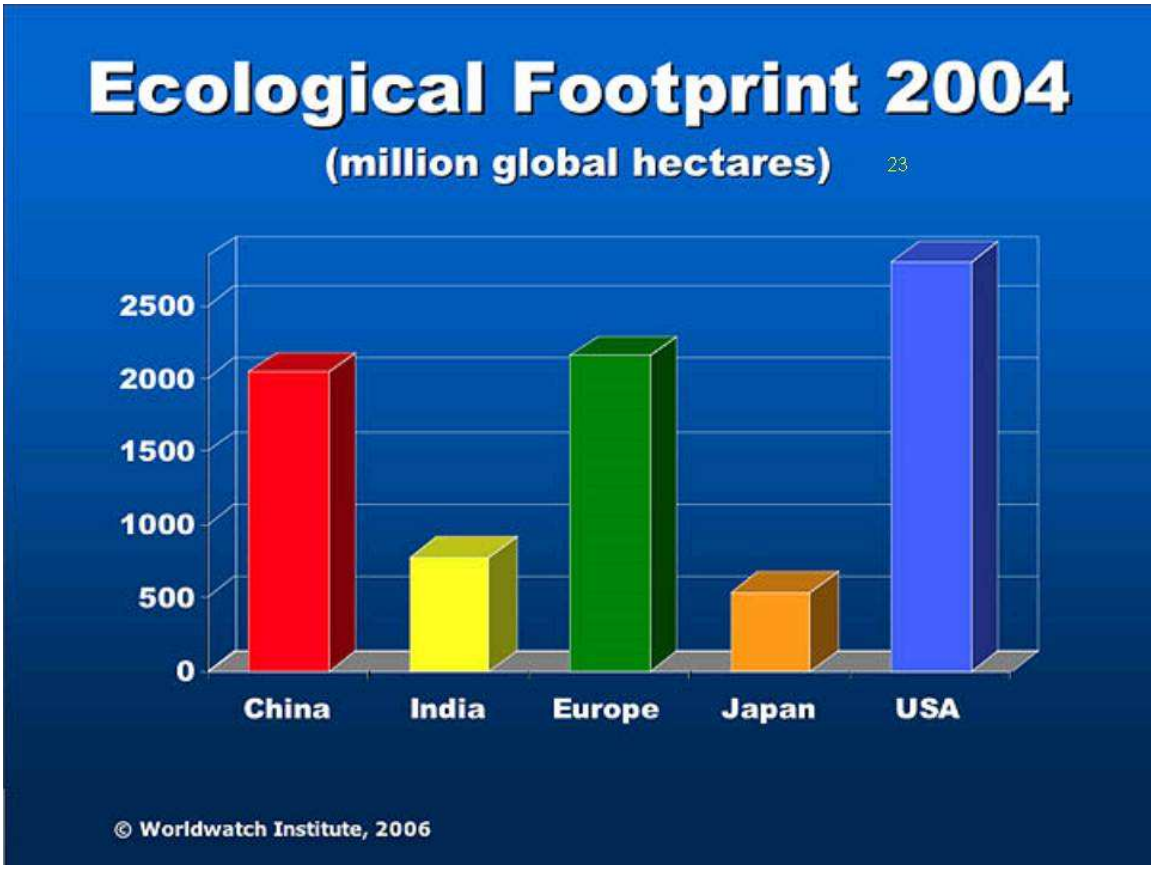

Clearly, the Western world is the major culprit – not the poorer nations. And considering our size, New Zealand's own footprint is pretty disgraceful.

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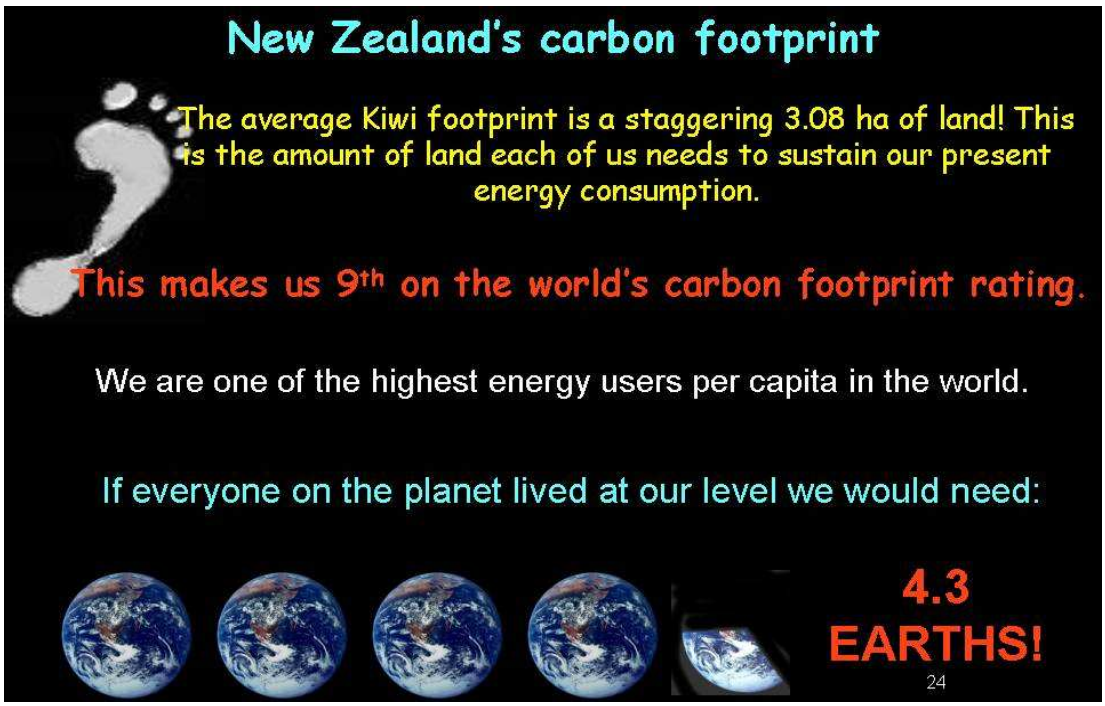

And we don't have 4.3 Earths!

Those of you who saw Al Gore's film, 'An Inconvenient Truth' will realise he feels we CAN save our planet if we ACT in time. For instance, what would happen if we could halt CO_2 production right now on a worldwide scale? Check out this graph.

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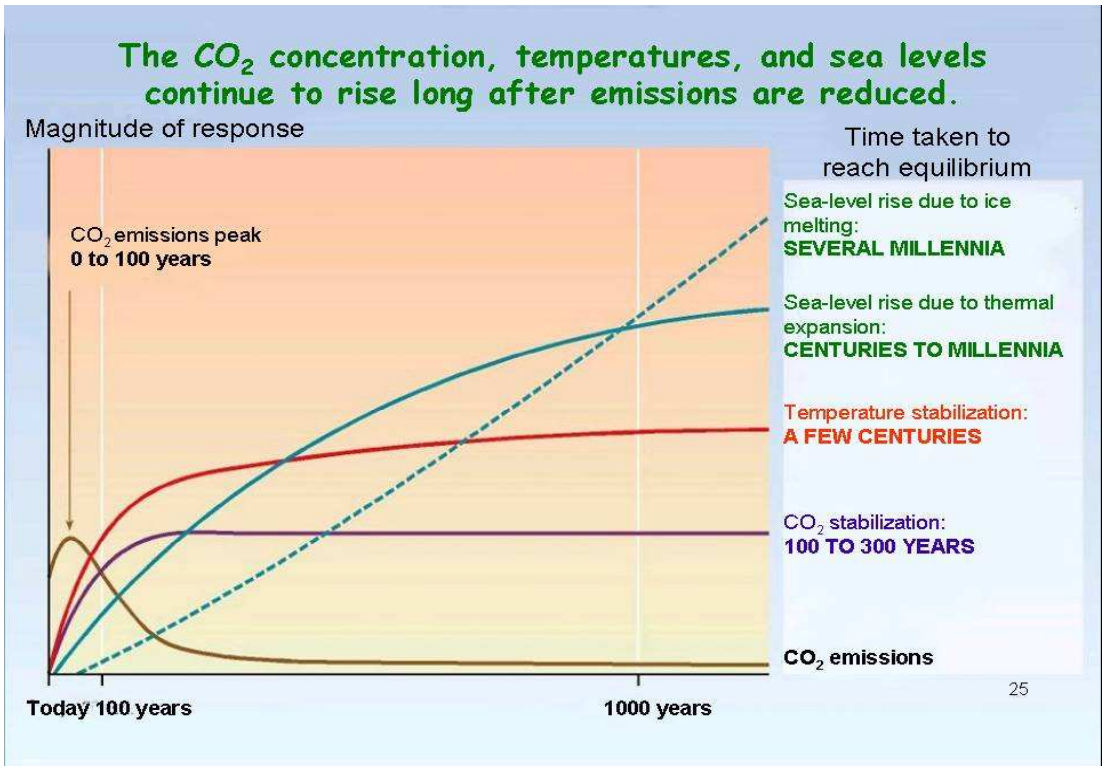

Temperatures and sea levels would continue to rise *long after emissions ceased*. This is ample reason to encourage immediate action on a global scale.

The melting of sea ice will not change sea levels. It is land ice melting that will cause sea levels to rise. So let us look more closely at the cryosphere - the ice and snow fields. For example, Greenland is showing clear signs of ice reduction.

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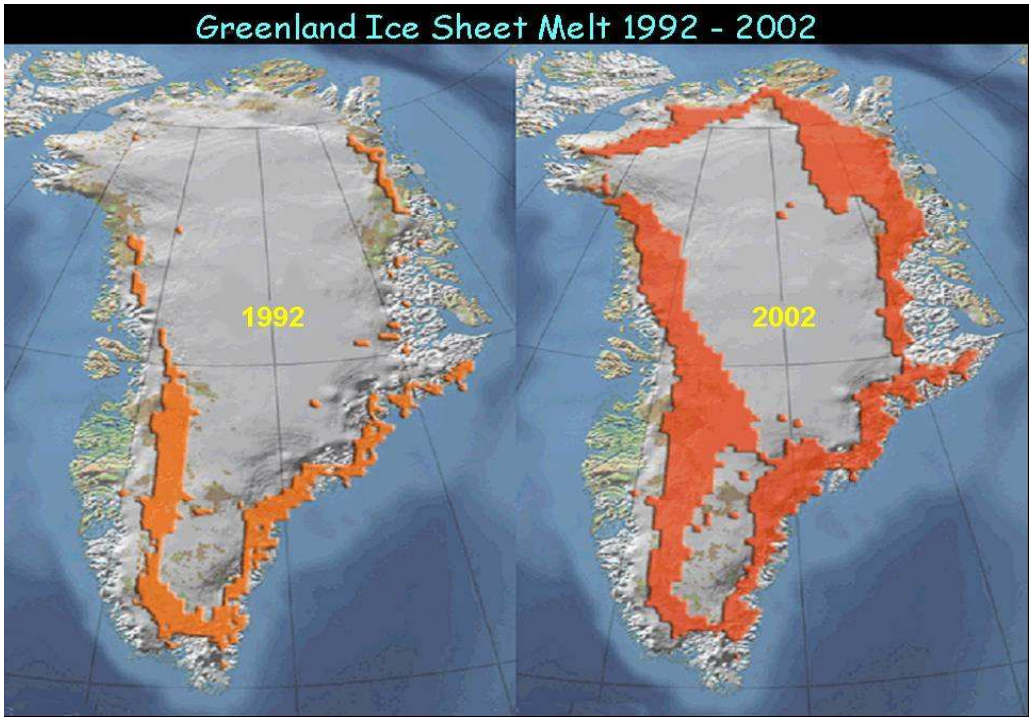

For updates, see https://www.google.co.nz/?gws_rd=ssl#q=Greenland+ice+melt+2014&tbm=nws and https://www.google.co.nz/search?q=greenland+ice+melt+2014&tbm=isch&tbo=u&source=univ&sa=X&ei=RrysU5-1MMOWkQWYqYDAAg&sqi=2&ved=0CCIQsAQ&biw=1280&bih=895.

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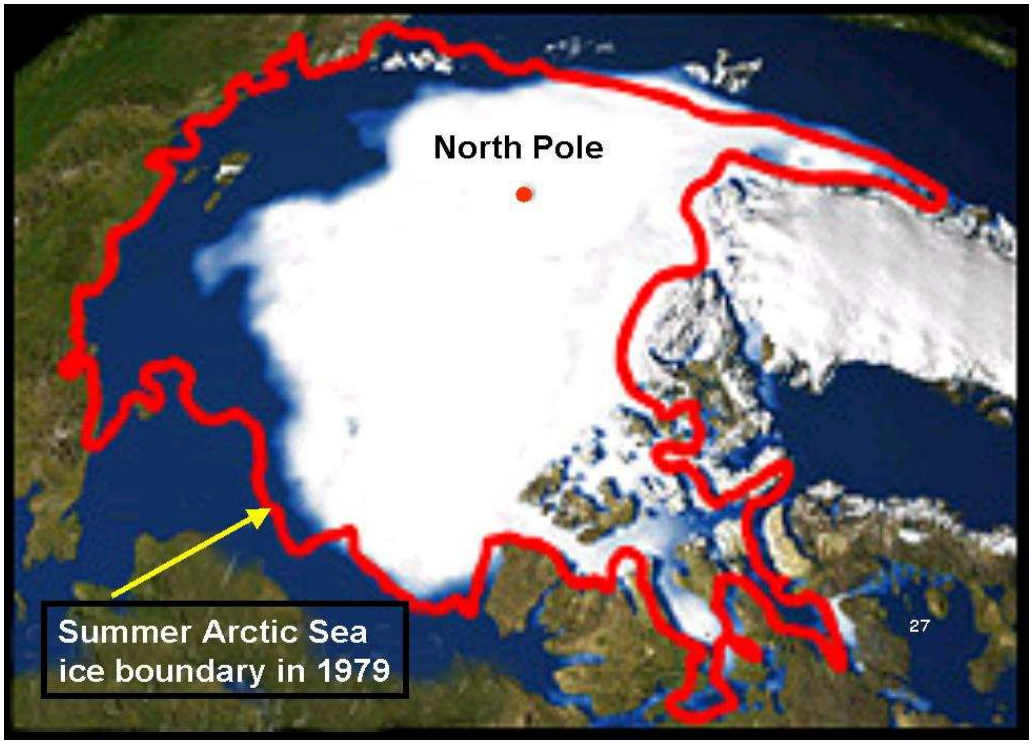
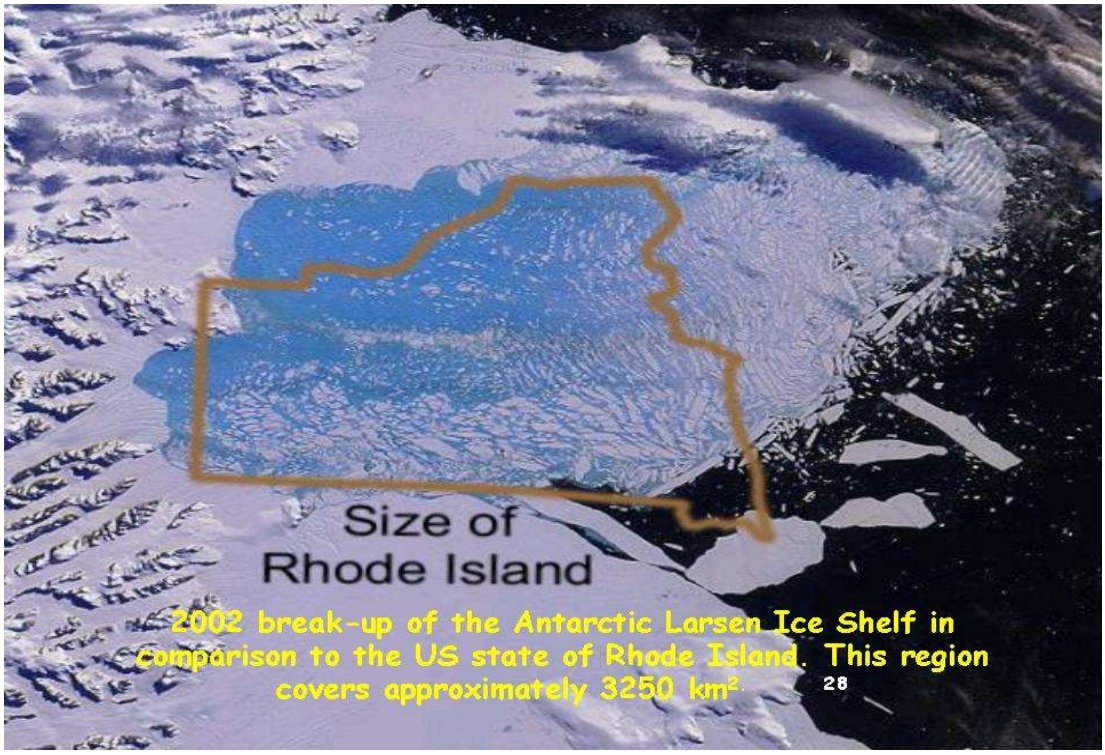


With the aid of satellite IR photography, scientists now have clear evidential proof that the arctic is thawing very rapidly.[1] [2] Northern and southern poles are showing changes, the southern ice sheets the least affected, but changes there are also discernible; the Larsen Ice Shelf in Antarctica particularly.

[1] "During the first half of July (2009), Arctic sea ice extent declined more quickly than in 2008, but not as fast as in 2007" (http://nsidc.org/arcticseaicenews). "Antarctic glaciers are melting faster than previously thought, which could lead to an unprecedented rise in sea levels." . . . "A report by thousands of scientists for the 2007-2008 International Polar Year concluded that the western part of the continent is warming up, not just the Antarctic Peninsula" (www.cbc.ca/world/story/2009/02/25/antarctic-warming.html).

[2] The *New Internationalist* (July/August 2009) 'Surviving change in the Arctic' has up-to-the-minute information, including graphic illustrations of the reduction in sea-ice in the Arctic Ocean and the ice-sheet over Greenland.

SLIDE 28



The 2002 break-up of the Larsen Ice Shelf was a warning to many scientists that changes are occurring more rapidly than expected.

The effect on the wild life, particularly Arctic polar bears, is sad to behold.

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Polar bears are drowning as they attempt to find firm ice floes that are simply no longer there; they have melted.

No longer able to find food, the bears are encroaching on human encampments, or eating other bears. A cartoon effectively says it all …

Slide 30

So much for the Polar Regions - what about glaciers? Most of us are not aware that many millions of people rely on glaciers for drinking water. And glaciers are disappearing worldwide. Let me show you.

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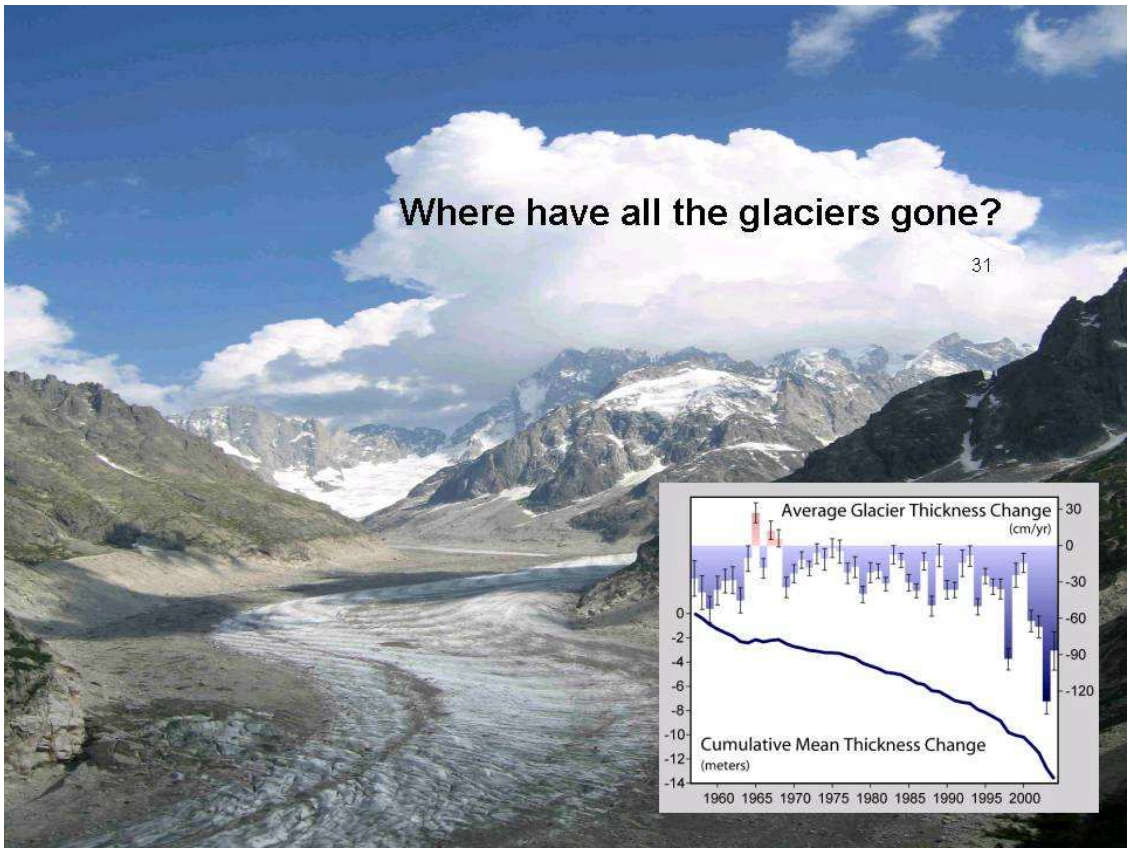
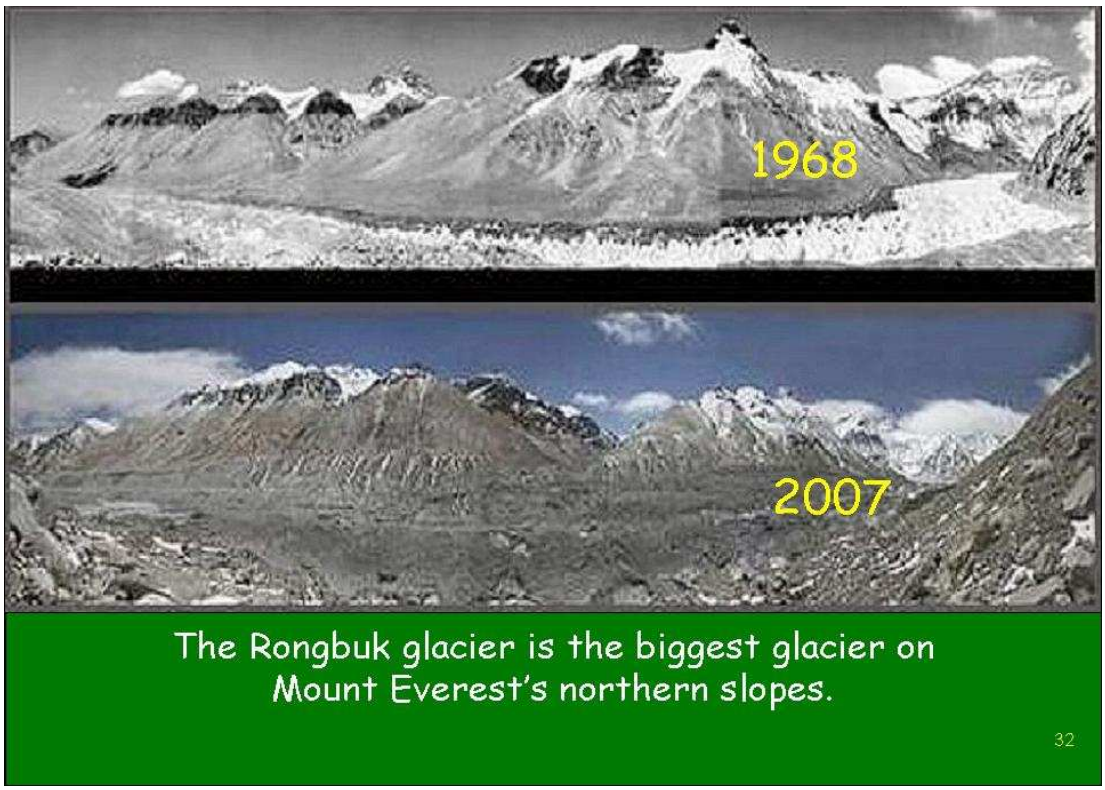


You can see from the small inset graph here the rate of thinning is extensive. One of the most astonishing examples is that of the great Rongbuk glacier on the northern side of Mount Everest.

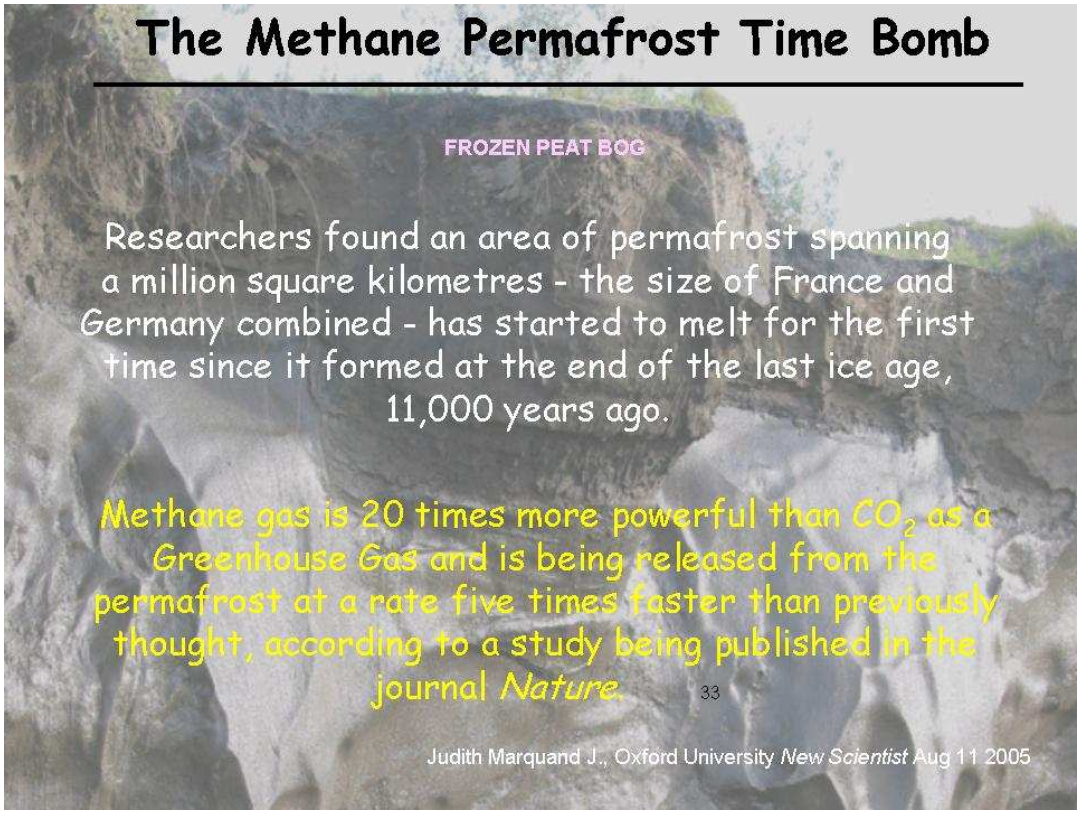
Slide 32



Those on the southern side are also melting. AND the inevitable result *on the southern side* will be that billions of people in northern India will eventually have no fresh drinking water from this source.

Before leaving the glacier and ice problem, I want to mention permafrost. Permafrost is also melting and this is a time bomb.

Slide 33



Some of the Inuit peoples are our first global climate environmental refugees. Why? Because their homes and towns are collapsing as the permafrost thaws.

Slide 34

Buildings are collapsing in Siberia and in Alaska. In Alaska, roads are collapsing and oil tankers can use the highway only for a few days annually.[1]

Now let us return to the ocean. Of enormous concern are the great ocean conveyer systems.

One of the first hints that something was seriously different to what we were all being told was published in a journal in September 2002 (Cambridge University). The report read: "Global Warming Surprise, A New Ice Age."

Oceanographers had discovered *a huge river of fresh cold water flowing into the Atlantic Ocean formed by the melting polar ice cap*. They warned: "it could soon bury the Gulf Stream, plunging North America and Europe into frigid winters."[2]

That was five years ago . . . and few people listened.

[1] The *New Internationalist* (July/August 2009) 'Surviving change in the Arctic' has up-to-the-minute information, and an illustration of houses slumping together as the permafrost thaws in Yukon, Canada.
[2] *Discover* magazine, September 2002

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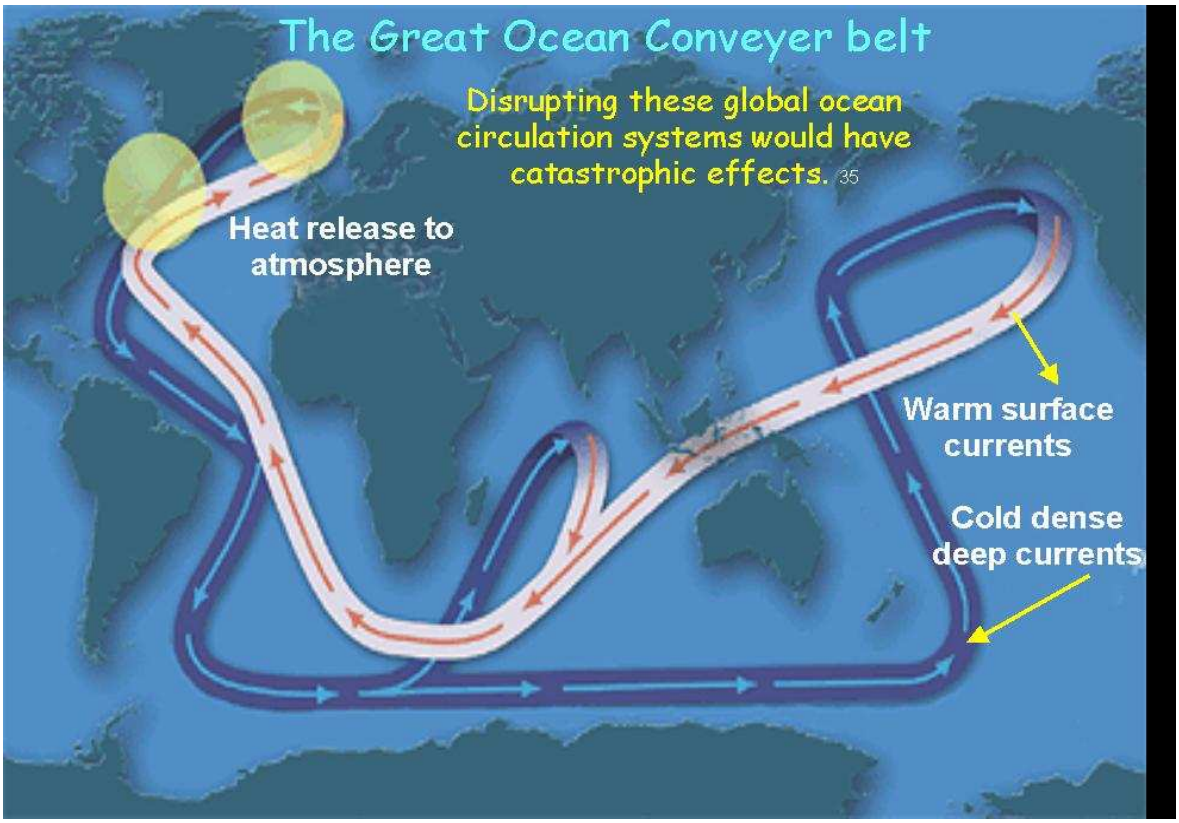


The great ocean currents have controlled temperatures on land for many millennia. If the Atlantic Gulf Stream fails, Europe would enter an ice age.

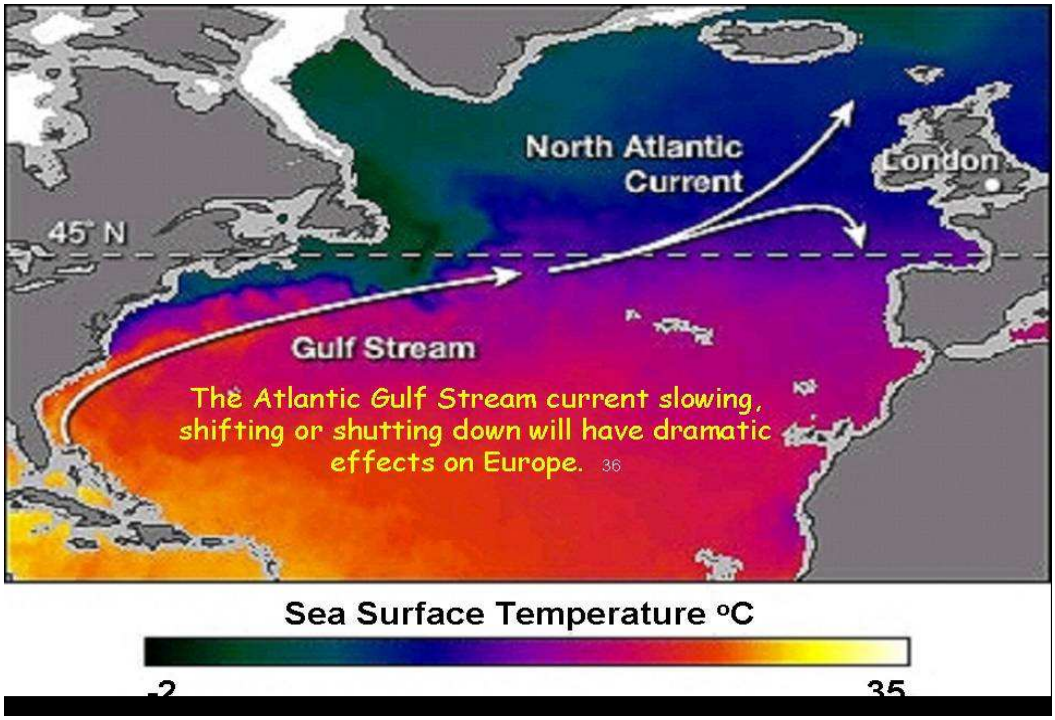
Let me quote a recent commentary on a Pentagon report:

"The change of shape of the Gulf Stream is the beginning of the breakdown and stoppage of this warm water current and the end of our civilization as we know it . . . the Pentagon report[1] believes that the Gulf Stream, from everything they know, is not just going to slow down, it is going to stop. The last time this happened was 8200 years ago . . . it left Northern Europe under a half mile of ice, and New York and England enduring Siberian weather. Further, it resulted in a true 'Ice Age' that *lasted over 100 years*."[1]

If we look at this as a temperature map, it is a little easier to follow

[1] A study conducted through the Pentagon's Office of Net Assessment, completed in October of 2003, named 'An Abrupt Climate Change Scenario and Its Implications for United States National Security.' www.accc.gv.at/pdf/pentagon_climate_change.pdf.
Reported in 2014, Arctic sea ice melt , the result of a rise in temperature, has altered atmospheric circulation in a way that led to extreme snow and ice in the Northern Hemisphere. The 2013–14 North American 'cold wave' extended from December 2013 to April 2014 with impacts as far south as Mexico: heavy snow and ice; aircraft grounded; electricity supply failures. See also "Is Shrinking Sea Ice Behind Chilly Spring?" National Geographic. 31 March 2013.

Slide 36



Scientists measuring the strength of the Gulf Stream have found the circulation has slowed by 30% since an expedition 12 years previously. Expeditions in 1957, 1981 and 1992 found only minor changes in the strength of the current flow, which slowing picked up in 1998. The decline led to establishing a network of moored instruments in the Atlantic to monitor changes continuously. Dr Harry Bryden, of Southampton's National Oceanography Centre, led the study. He says: "Models show that if it shuts down completely, 20 years later, the temperature is 4C to 6C degrees cooler over the UK and north-western Europe" (www.guardian.co.uk/environment/2005/dec/01/science.climatechange).

Another marker for this slowing down is changes in salinity of our oceans. The diluting effect at the poles and the concentrating effect at the equator will further encourage the conveyer to slow down.

The temperature increase in the ocean is killing off coral reefs.

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With the continued collapse of these systems, we could be left with a dead ocean. (Google 'ocean dead zones' and www.conservation.org/oceans.)

Coral reefs are probably the most complex ecosystems on the planet and home to thousands of species. Also, they support the lives of millions of people in tropical zones.

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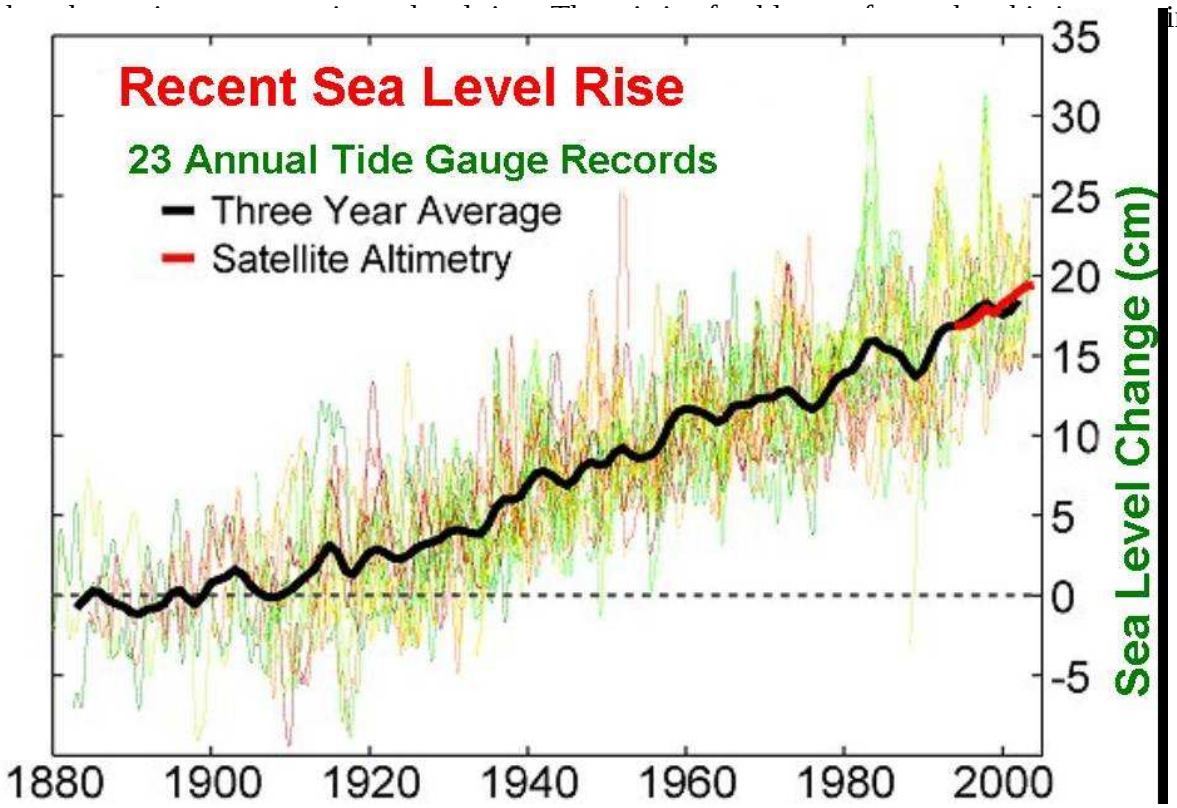

Rises in sea levels will affect all low-lying human and animal habitats. A perfect example is Bangladesh.

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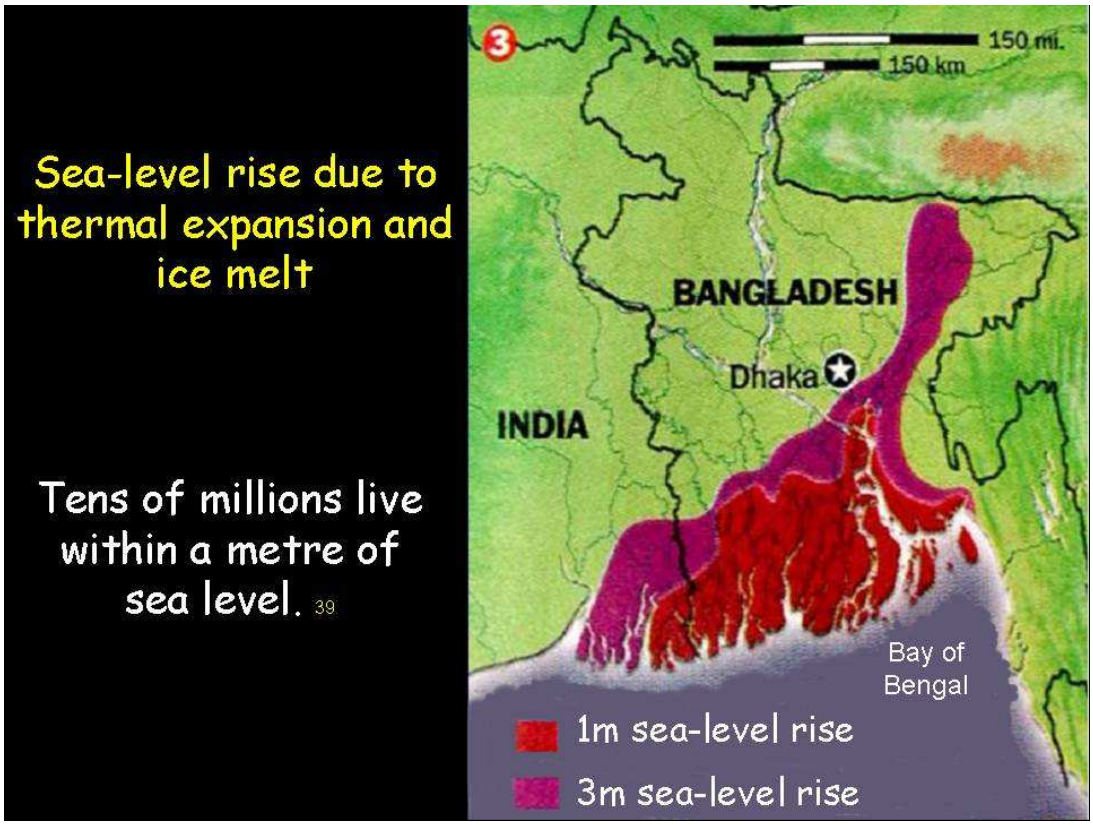


Worldwide, perhaps billions of people live in areas that are below or at the levels of projected rises. Potentially, whole communities will have to be relocated.

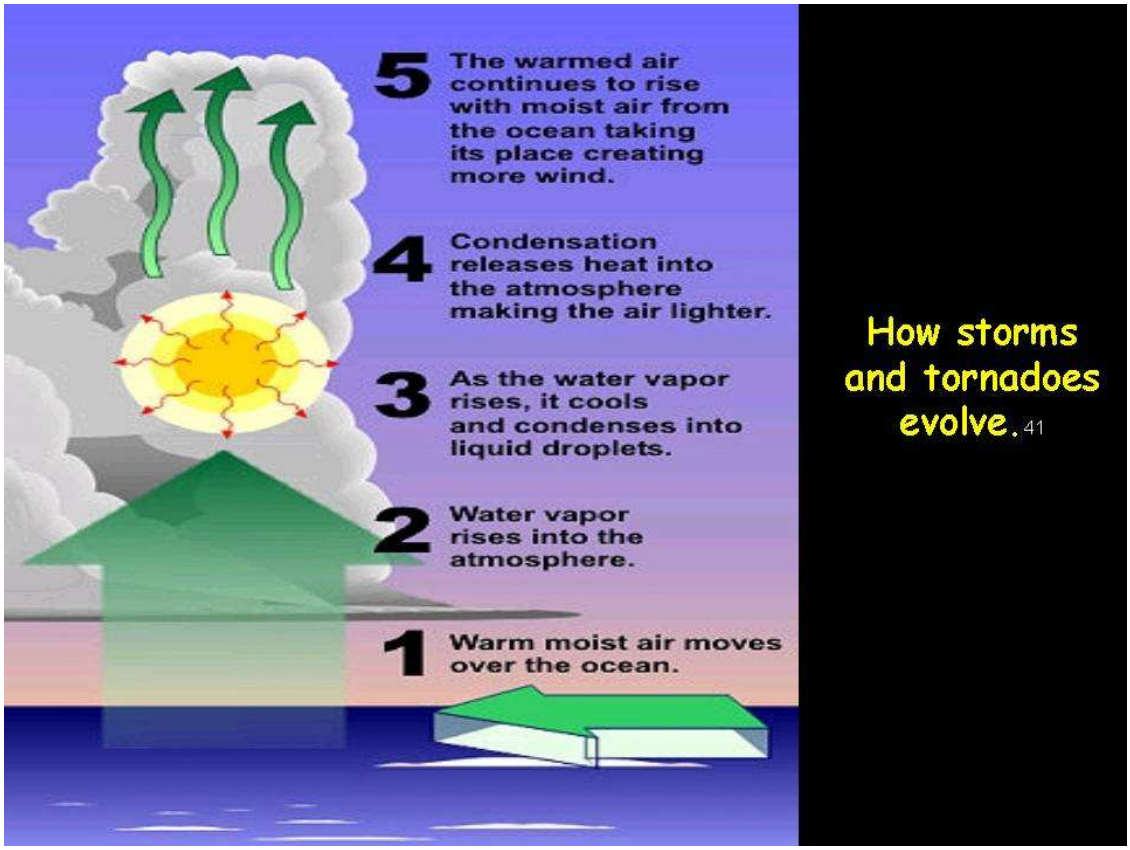
In fact, it is happening in Bangladesh and in the Pacific islands already.

Slide 40

Tuvaluans will probably be the first 'tidal' refugees. Many other tropical islands fall into this same category.

As sea temperatures rise, storms will increase, both in number and ferocity. It is worth just revising our ideas on how these occur.

Slide 41



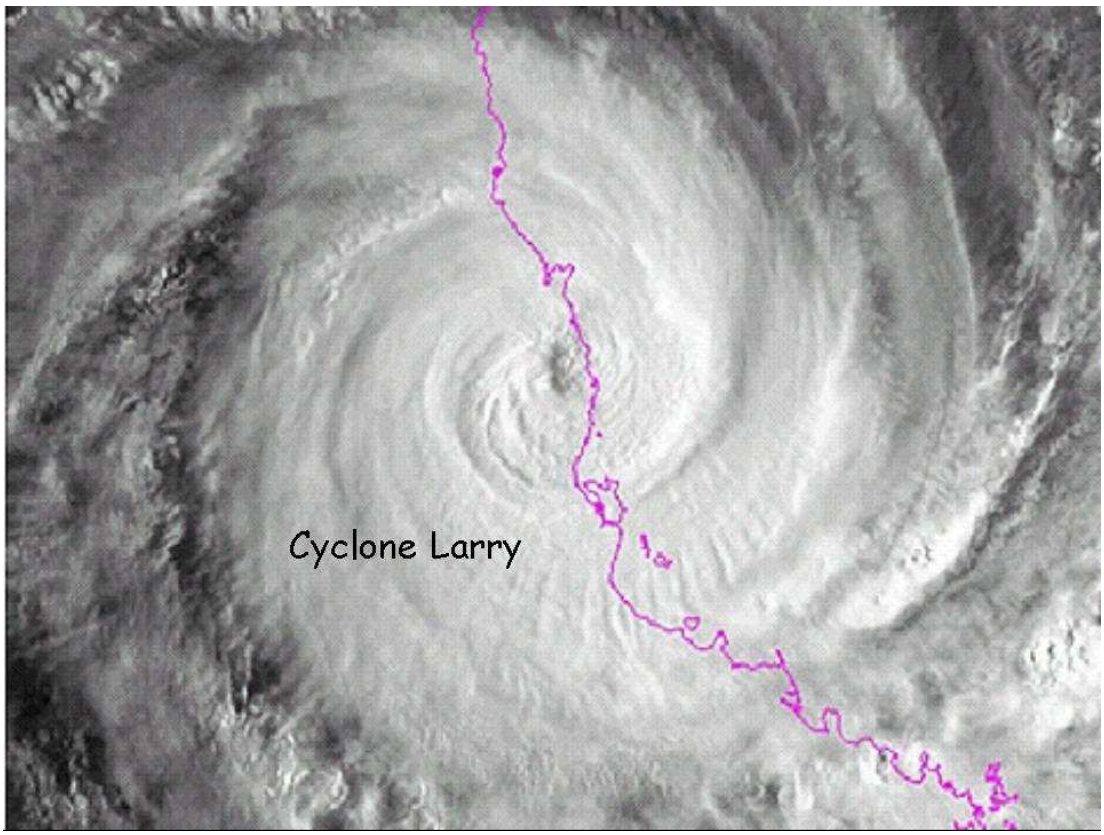
The result of this heating gives rise to more intense and destructive storms.

Slide 42

Surface temperatures are very delicate and their balance easily disturbed. We need only small increments of temperature – 1^{o} or $2\ ^{o}C$ - to make *enormous differences* to Earth's thermal stability. The UK's chief scientific advisor, Sir David King, has said - and I quote: "A global rise in temperature of $3^{o}C$ will put a further 400 million people at risk from hunger, destroy half of the world's nature reserves, and cause cereal crop yields to fall between 200 and 400 million tons."

The result of this kind of heating gives rise to storms such as the recent tropical "cyclone Larry" which made landfall in Australia during the 2005–06 Southern Hemisphere tropical cyclone season.

Slide 43



These heating effects cause the physical size of storms and wind speed to increase enormously. *Can you even imagine* the wind speed that would be required to do this?

Slide 44

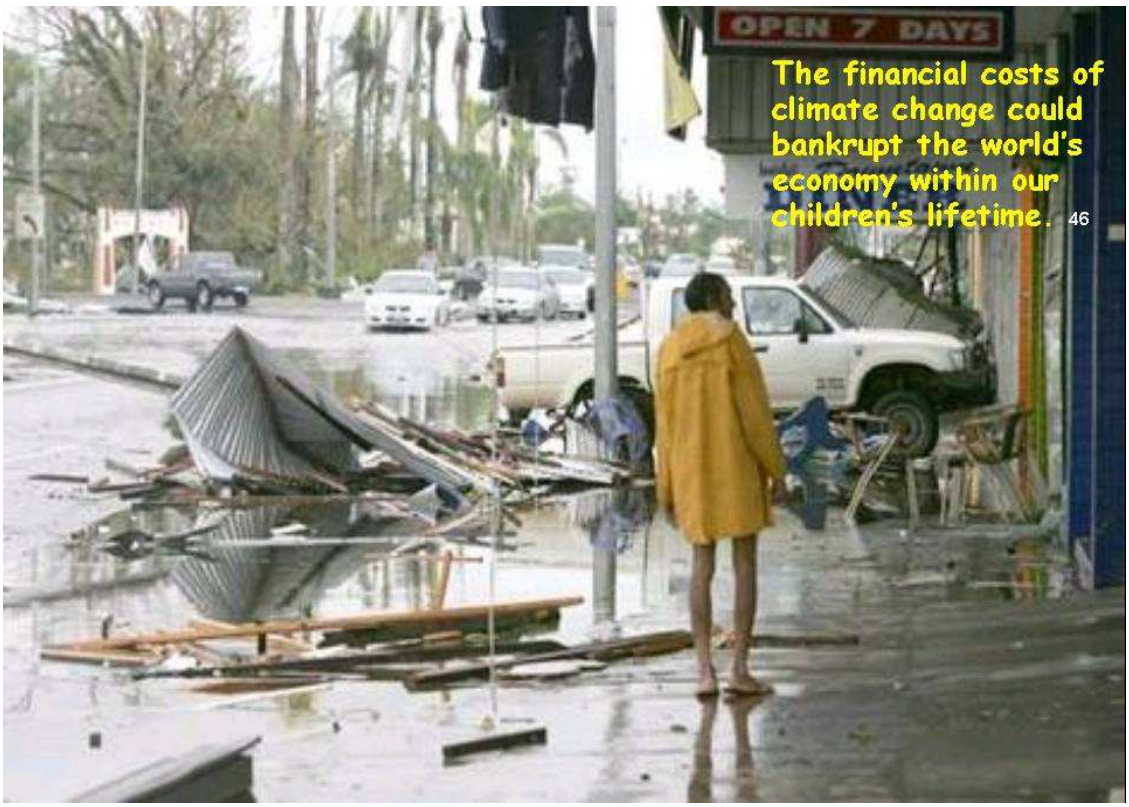
Look at some of the devastation Cyclone Larry caused.

Slide 45

In New Zealand, we have little appreciation of the devastating wind velocities generated by these kinds of storms, although we have had a taste with the recent New Plymouth tornadoes and Cyclone Bola which hit the East Coast in 1988. The areas where we expect storms and cyclones to start are also growing as ocean temperatures increase.

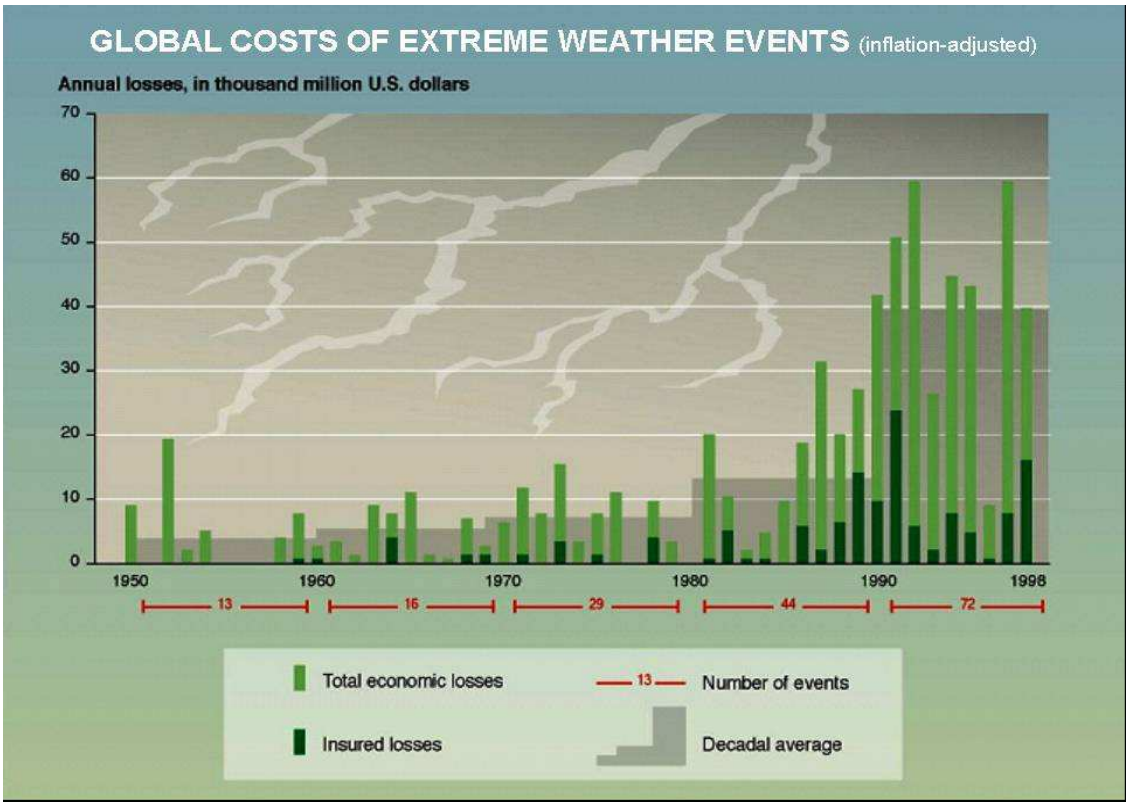
Aside from the obvious dangers, there are growing costs for people. How do we insure our homes?

Slide 46



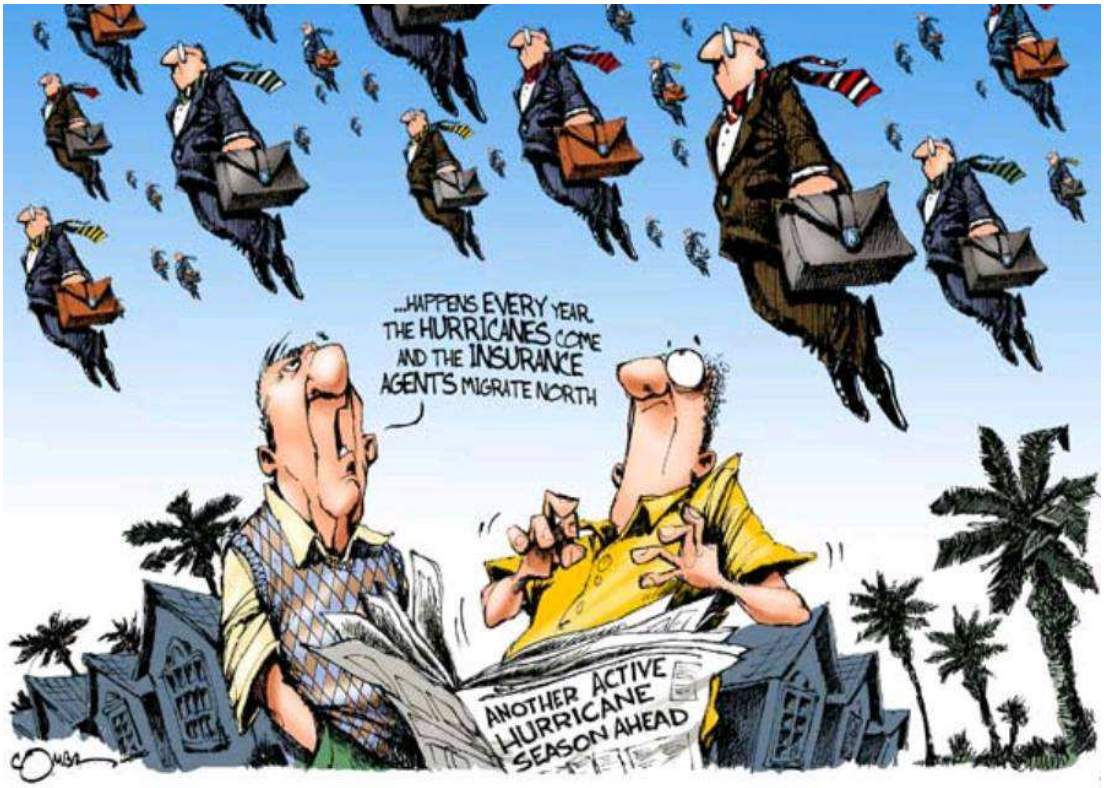
The insurance industry acknowledges the enormous economic costs associated with climate change. Their outlay will become astronomical - and premiums unrealistic. It is instructive to look at the global effects on the insurance industry over the last 50 years or so.

Slide 47



From 1980 to 1998, there were enormous economic losses. Two major reports forecast massive potential costs from floods, storms and heat wave damage – as a result of climate change. Both reports, published in June 2005, called for immediate action from governments and the financial industry to avoid these crippling cost implications.[i] Once again, it takes the irony of a cartoon to illustrate this …

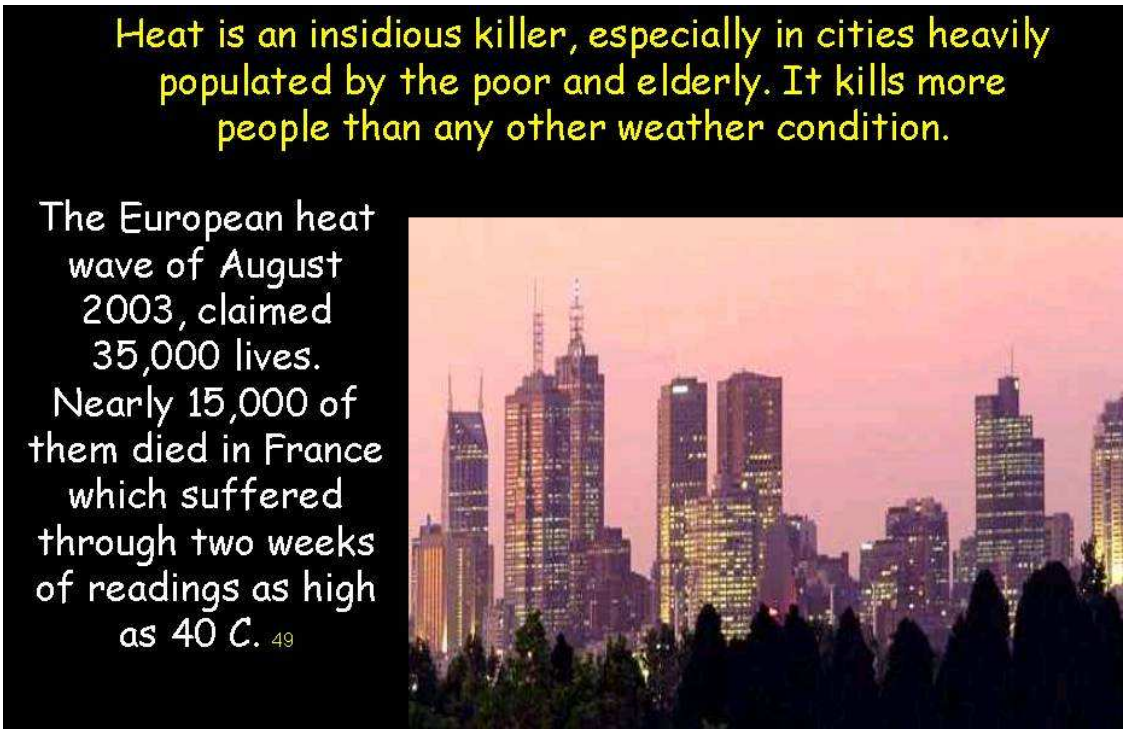
Slide 48



Any process using fossil fuels pours CO_2 into Earth's atmosphere. This leads to an increase in Earth's temperature. Do not be fooled by temperatures of just one or two degrees. On a environmental scale, this is bad news globally.

We humans are very delicate creatures as far as temperature is concerned. On average, we can survive in a narrow band of temperature only a few degrees overall; from 1^{o} or 2^{o}C, up to around 45^{o}C, with a few exceptions. Like many creatures, outside those figures we die. In India, temperatures can reach 50^{o}C: *half way to boiling point*. The majority of us would not survive in those temperatures.

Slide 49

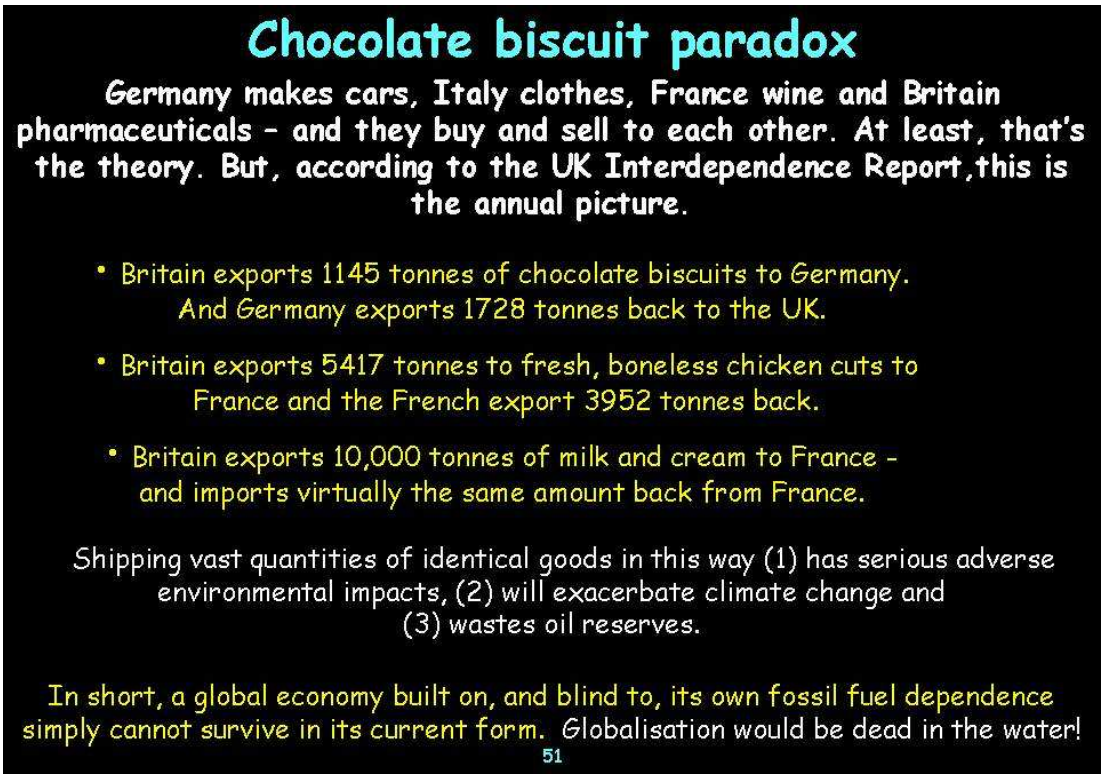


Now let us look at climate change and food production. How will we cope with an escalating population? Many assume that with extra warmth we are able to grow more, but this is not necessarily so.

Slide 50

Population increases will mean greater demands for food. We are already witnessing droughts in nations where food supply is volatile. Soil degradation will increase - together with an increasing loss of biodiversity. Whole species are already vanishing. Why does this occur? Simply because commerce cares little for the enormous footprint it makes on Earth's resources: trade is the god of industry. Let me give you just one absurd, but classic example of this.

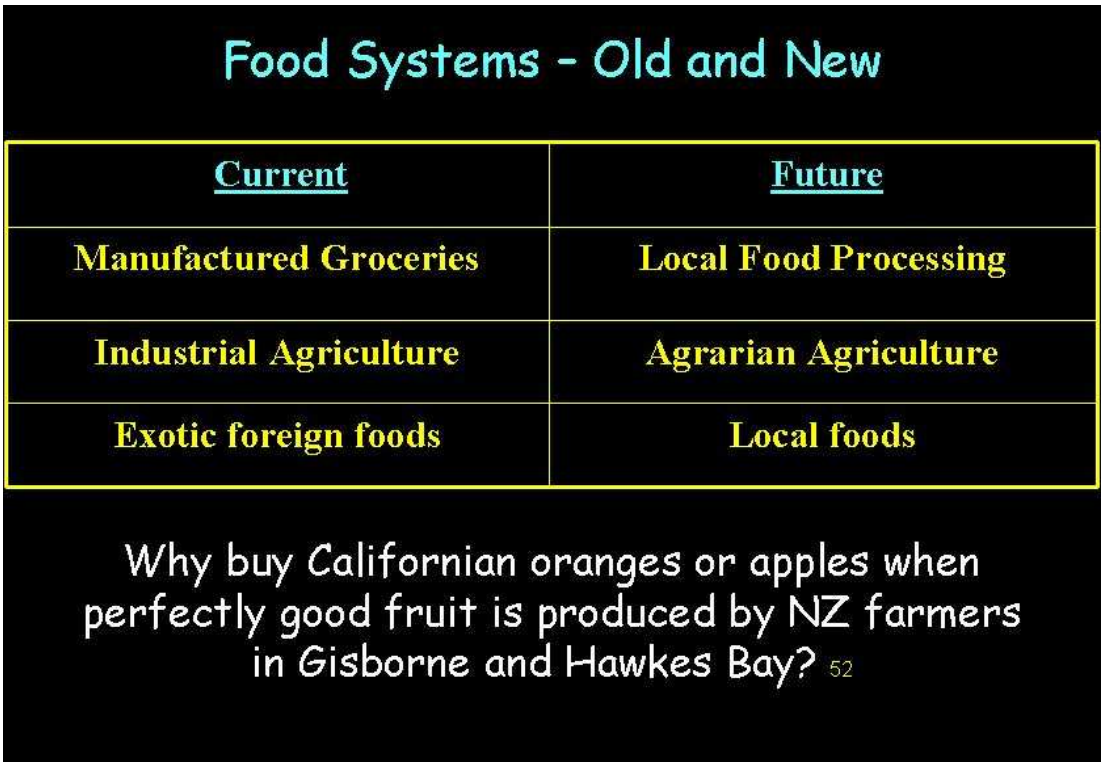
Slide 51



The wastage of fuel used in this caper is enormous – and so are the effects on climate change and the environment. We should be tackling the global food distribution system – when in fact our politicians are fighting tooth and nail for what… more free trade agreements that could exacerbate the problem?

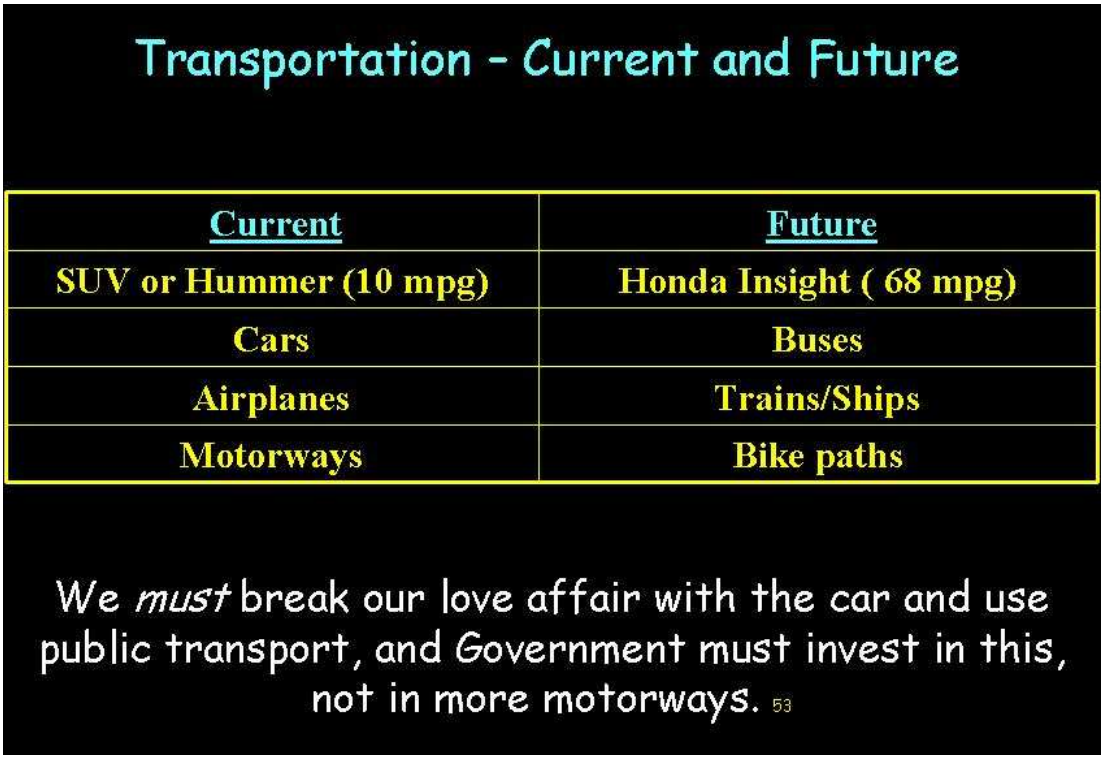
What we should be doing is returning to sustainable options - buying locally produced food and goods - in short doing what Cuba was forced to do when its oil supplies were stopped.

Slide 52



The same logic applies to decisions over transport. What are governments doing? Putting billions into motorways.

Slide 53

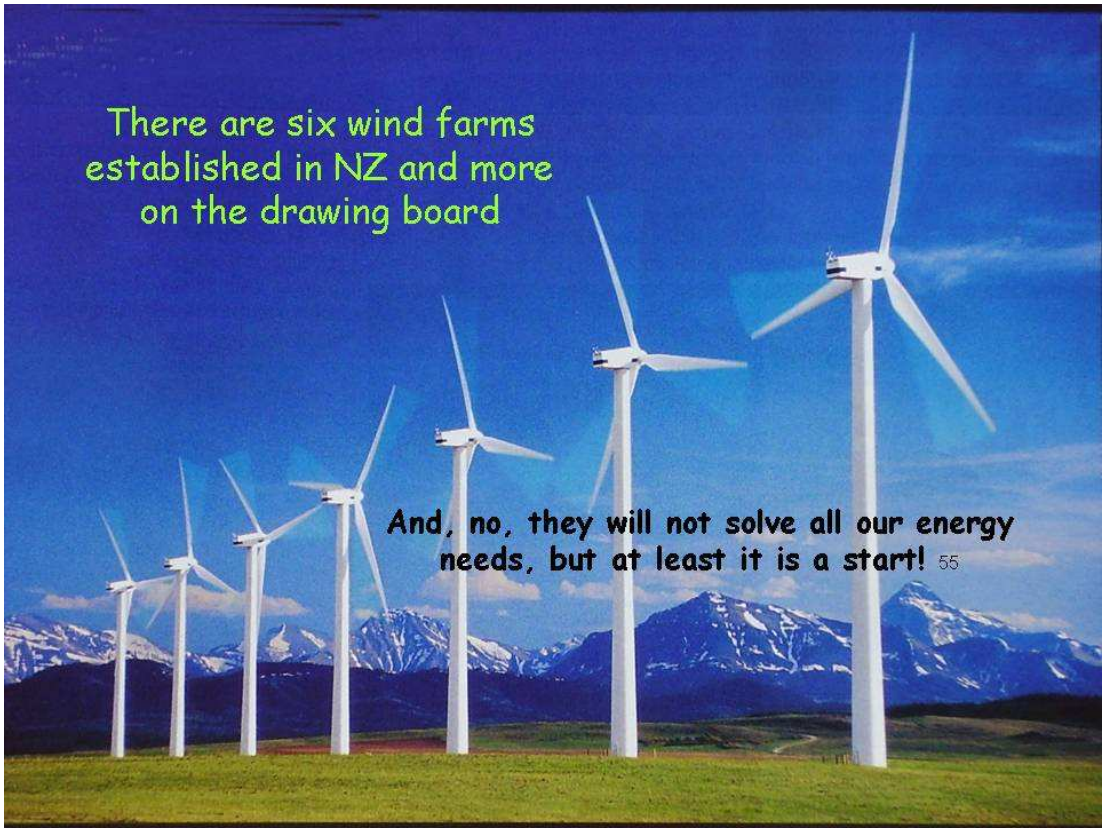


Climate change should be at the very top of the political agenda. It is an issue that affects every human being on this planet.

Slide 54

New Zealand *is* making small inroads into the energy problem – but not fast enough. Again, I am not being melodramatic when I say we need to be moving at wartime speed on this.

Slide 55

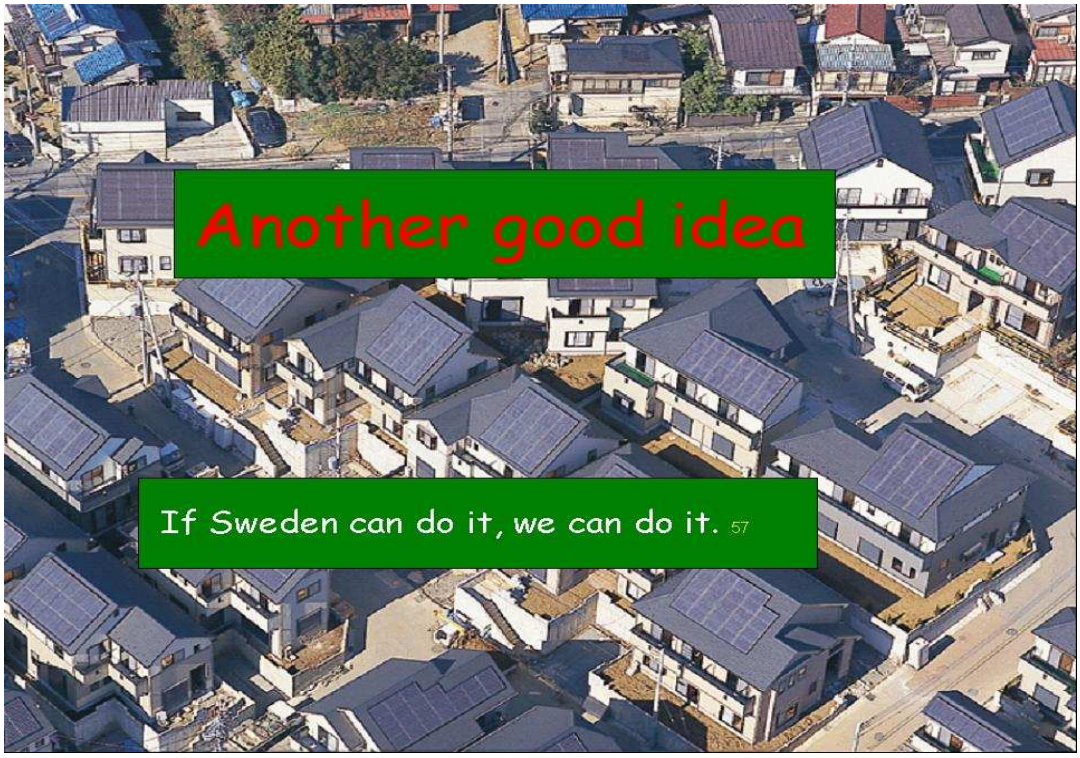


Like Iceland, New Zealand is lucky to have geothermal energy that we can use.

Slide 56

Another fuel saver is the solar panel. Sweden offers government grants for installation on new buildings. Sweden has also declared that she will be fossil fuel free by 2020.

Slide 57



For those who feel that the nuclear option is a good alternative let me dispel the idea. For one thing, science tells us that uranium reserves are too small to provide the volume that would be demanded long term. Of more importance is the fact that we have virtually poisoned the Northern hemisphere - with both chemical and radioactive toxins. In New Zealand, we also have to consider the earthquake risk. Japan recently had to shut down three Nuclear Power Stations due to earthquake damage.[2] And there is the enormous problem of radioactive waste. Using nuclear energy really is not a valid, long-term, environmentally friendly option.

[2] Added June 2014: Fukushima Daiichi Nuclear Power Plant disaster should be sufficient warning.

The solution is actually in our hands:

Slide 58

Do not cling to the hope that climate change sceptics might be right. I hope I have convinced you they are not, that it is vital we tackle this issue now. The September (2006) issue of *Scientific American* concluded – and I quote: *"The debate on global warming is over."*[1]

Climate change is happening and we need to act immediately in whatever way we can. If we have only one tree standing, I believe we should fight for it. *But if we do nothing* we will leave an appalling legacy for future generations to inherit.

Slide 59

[1] http://www.scientificamerican.com.

A common question is *what difference can I make*? We should recognize that collectively we *can* make a difference. I will give you a simple example. Think back to the days before recycling became popular – when everyone threw everything out in the trash. In less than 20 years, most households have gone from recycling nothing to recycling newspapers, plastics, glass and metal. Many businesses recycle paper and buy and/or manufacture products with recycled components. Many industries practice 'source reduction' in their packaging efforts.

An entire mindset has changed in one generation. So we can make a difference? Yes, we can.

Just in case you still have a hint of doubt about climate change, the next slide should convince you that it really *is* well under way…

Slide 60

Joking aside, let us get busy on this and keep in the forefront of our minds the prophesy of that old Indian Cree Chief which has never been more relevant.

Slide 61

Slide 62 World's experts

READ WHAT THE WORLD EXPERTS HAVE TO SAY

Union of Concerned Scientists
www.ucsusa.org/global_warming/science/

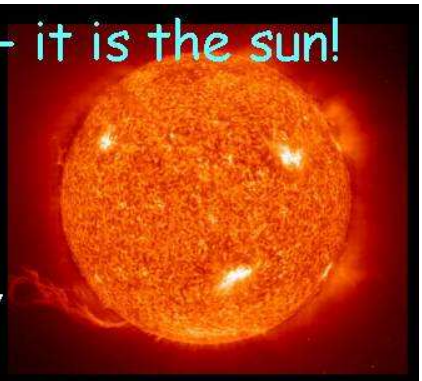
Peak Oil & Energy Collapse
http://www.peakoil.net/

Intergovernmental Panel on Climate Change
www.ipcc.ch/pub/pub.htm

The Final Proof:
Global Warming is a Man-Made Disaster
www.publications.parliament.uk/pa/cm200405/cmselect/cmenvaud/105/10505.htm

Slide 63

The Most Common Myth - it is the sun!

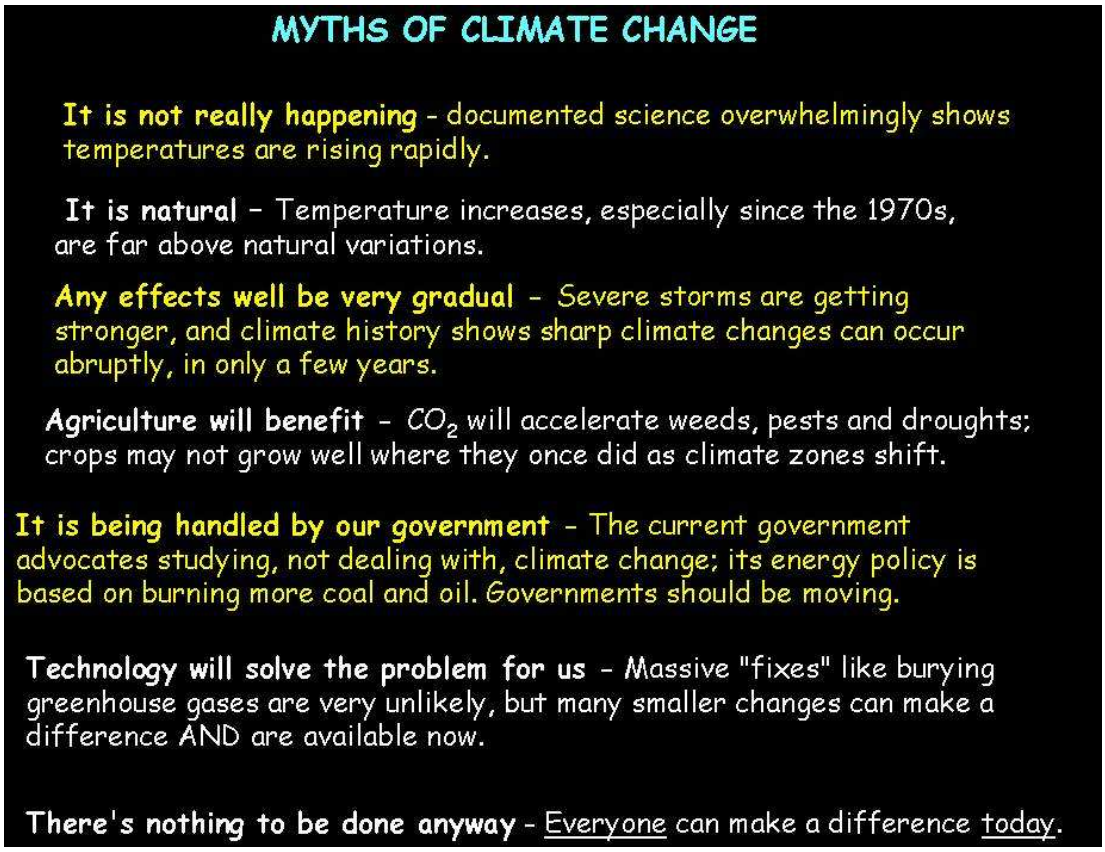


The most common myth to debunk climate change is that many planets are heating up and the sun is the cause. Dr Ka-Kit Tung and colleagues from Washington University have proven conclusively that this is false.

After analysing the data on solar radiation over the past 50 years, covering 4.5 solar cycles, they have shown that this oscillation was almost 0.2 °C between high and low points in the cycle.
[New Scientist 11 August 2007]

These findings provide real-world evidence that climate change predictions support human-generated warming. 63

Slide 64



Enquiries for *Exploding the Myth of Cheap Oil: Rebuilding our lives after Peak Oil* and other books written by Robert Anderson should be directed to connectedbooks@clear.net.nz.