SCHOOL OF ENVIRONMENT

"Responding Positively in a Time of Climate Change"
Nelson, August 3rd, 2011

Climate Change: The science and its impacts

Dr Jim Salinger,
School of Environment
University of Auckland
j.salinger@auckland.ac.nz

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau

New Zealand 20,000 years ago

- Sea level 120m lower
- Walk from New Plymouth to Nelson
- Canada under 2km of ice
- Global temperatures 6° lower
- Most of last million years like this

CO_2 and Temperature

- Joseph Fourier – 1820s
  - Speculated that the atmosphere keeps the Earth warm

- John Tyndall, Irish earth scientist, 1860s
  - Found the key greenhouse gases
    - Block heat from escaping to space

- Svante Arrhenius, Swedish chemist, ~1900
  - Doubling CO_2 would raise temperatures 5°C

- Athol Rafter, DSIR scientist, 1950s
  - Noted that fossil carbon building up in atmosphere

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

CO_2 and Temperature

CO_2 doubling best estimate 3°C
(2.0 - 4.5°C)
This century

CO_2 concentration now 38% above pre-industrial
Half that increase in last 30 years

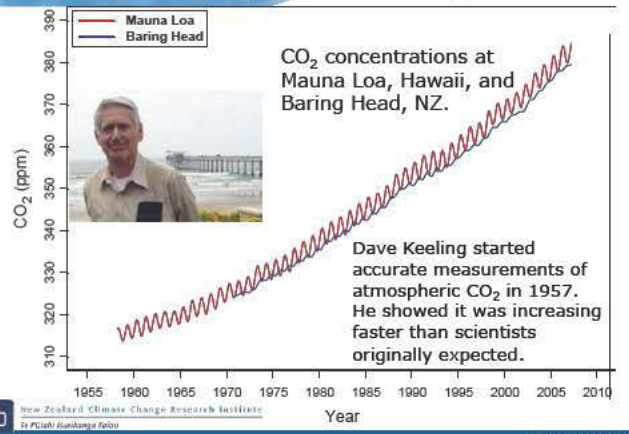
Most of the CO_2 there for centuries to come
Oceans & ice sheets take centuries to adjust

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

The greenhouse effect

- Long-term balance controlled by:
  - Amount & distribution of sunlight (nature)
  - Greenhouse gas concentrations (man & nature)
- Atmosphere is 0.04% CO_2
  - Difference between +15°C and -18°C

Increases in greenhouse gases

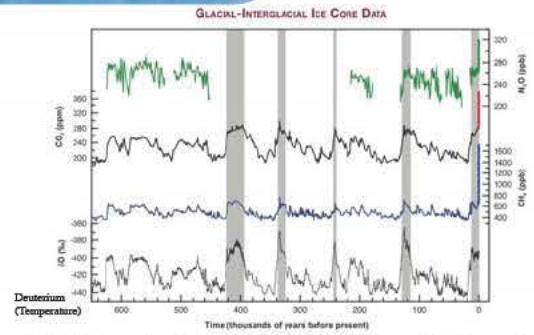


CO_2 concentrations at Mauna Loa, Hawaii, and Baring Head, NZ.

Dave Keeling started accurate measurements of atmospheric CO_2 in 1957. He showed it was increasing faster than scientists originally expected.

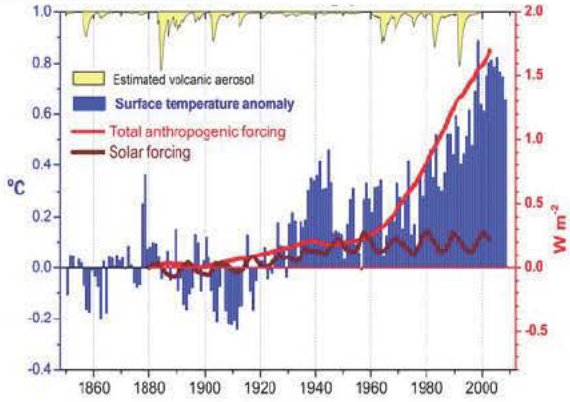
New Zealand Climate Change Research Institute

Increases in greenhouse gases

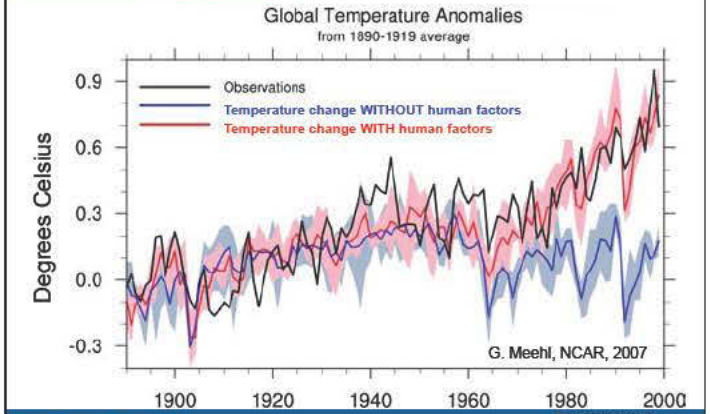


- Global atmospheric concentrations of CO_2 and CH_4 have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice core measurements spanning the last 650,000 years.

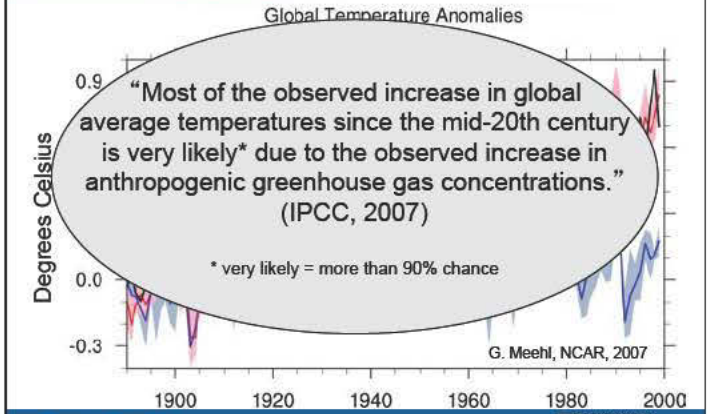
Sources of climate change



Sources of climate change



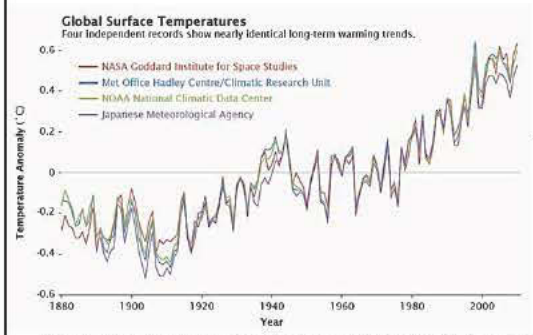
Sources of climate change



"Most of the observed increase in global average temperatures since the mid-20th century is very likely* due to the observed increase in anthropogenic greenhouse gas concentrations." (IPCC, 2007)

* very likely = more than 90% chance

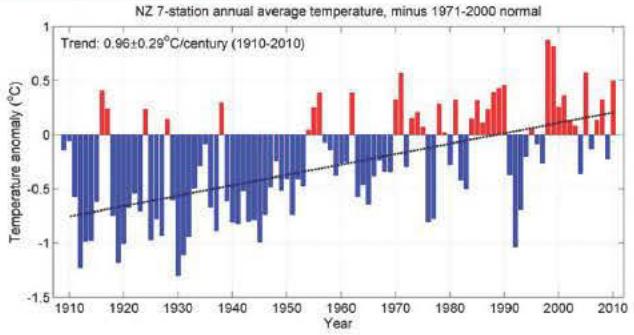
The climate is changing



Temperatures are rising

Results from four global datasets: NOAA (NCDC Dataset) , NASA (GISS USA), combined Hadley Centre and Climate Research Unit (UK) and Japanese Meteorological Agency (JMA)

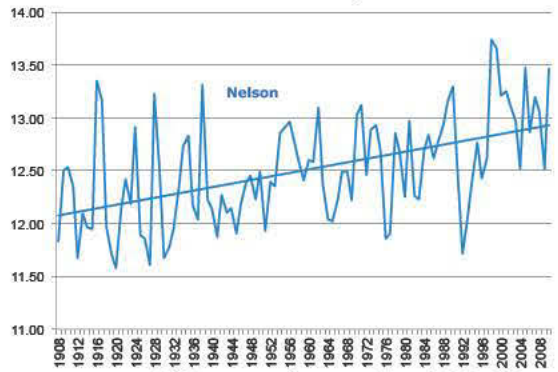
The climate is changing



- 100-year change & year to year change about 0.9°C

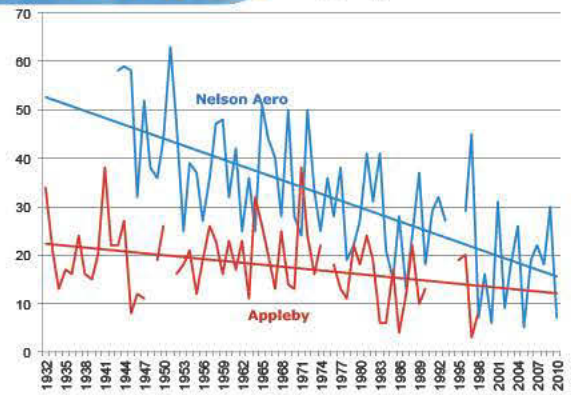
The climate is changing

Annual mean temperature



- 100 -year change about 0.8 °C

The climate is changing



Less frosts now occur

Extremes are increasing

Europe August 2003

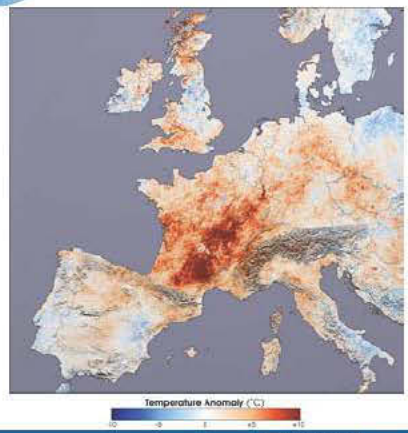
Wide area temperature anomaly of about 3ºC

Was more than 7ºC warmer than usual in some places

About 30,000 premature deaths

Unprecedented drop in crop yields

This is now twice as likely as it was 50 years ago due to global warming



Extremes are increasing

- **2010 Pakistan record breaking floods** began in late July 2010, resulting from heavy monsoon rains in Pakistan and affected the Indus River basin
- Drought and widespread fires in Russia at the same time as near-record flooding across much of China is raising the question of correlations between extreme events
- Extremes like this have been expected to become more frequent, for some time
- But climate scientists are now concerned about likely connections between them

Extremes are increasing

25pc of annual rainfall in two days for Napier
By Amelia Wade and Paul Harper

Some Napier residents may not be able to return to their homes for months because of this slip on Breakwater Rd. Photo / APN
Napier has received a quarter of its annual rainfall in just a 60 hour period this week, the MetService says.
The Civil Defence yesterday declared a state of emergency for the Hawke's Bay region after flooding and slips closed roads and forced the evacuation of more than 100 people from 14 coastal communities.

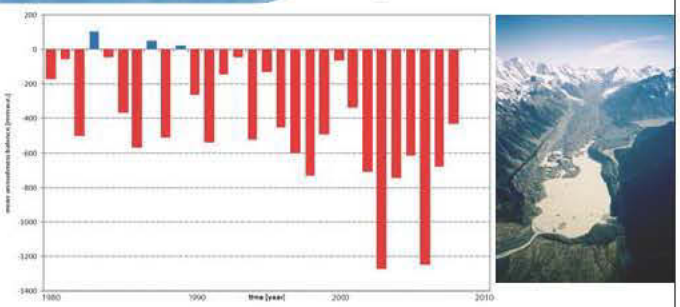
Location	Extreme 1-day rainfall (mm)	Date of extreme rainfall	Year records began	Comments
Te Puke	116	25th	1973	3rd-highest
Whatawhata	94	25th	1952	3rd-highest
Hamilton	70	25th	1985	3rd highest
Napier	125	26th	1870	3rd highest
Wairoa	128	27th	1967	3rd highest

Extremes are increasing

Global warming 'influencing weather extremes'
by Isaac Davison 5:30 AM Friday Jul 15, 2011

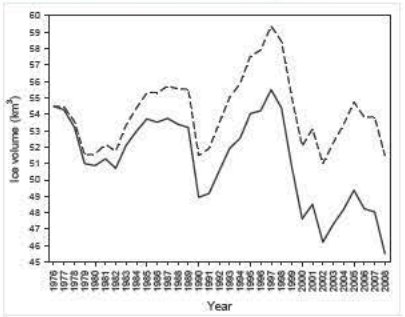
Human-influenced global warming has played a role in the severe weather events in New Zealand and abroad over the past year, says a visiting climate expert, Christchurch-born climate scientist Kevin Trenberth, now employed by the US National Centre for Atmospheric Research.
Weather-related disasters in the past year range from a heatwave in Russia to flooding in Pakistan, China, India, and Queensland and drought in Brazil. New Zealand also broke temperature and rainfall records and experienced a deadly tornado in Auckland. After the deadly US spring storms, Dr Trenberth said: "When natural variability is compounded by human influences on climate this is what we get. Records are not just broken, they are smashed.

Glaciers are shrinking



Glaciers are shrinking world wide

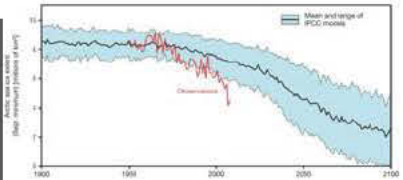
Alpine Response



Total volume change of alpine ice (solid line)

- Southern Alps ice volume has decreased 16% from 55 to 45 km³ 1976 - 2008

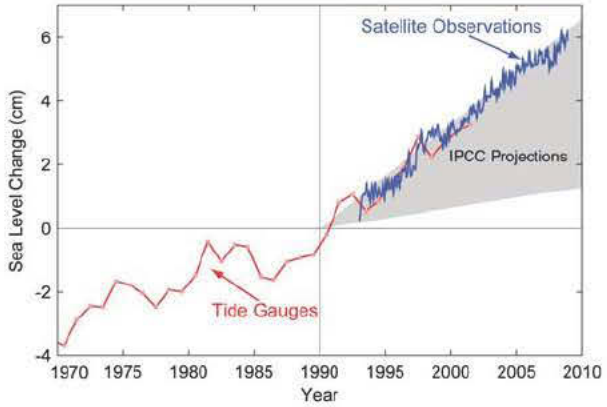
Arctic sea ice



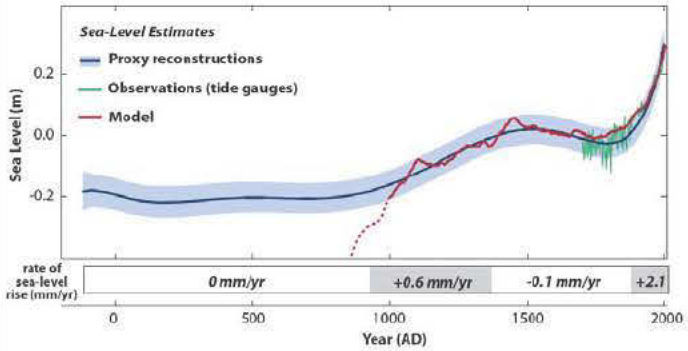
Observed (red line) and modelled September Arctic sea ice extent in millions of square kilometres. The solid black line gives the ensemble mean of the 13 IPCC AR4 models while the dashed black lines represent their range. From Stroeve et al. (2007) updated to include data for 2008. The 2009 minimum has recently been calculated at 5.10 million km², the third lowest year on record, and still well below the IPCC worst case scenario.

THE UNIVERSITY OF AUCKLAND NEW ZEALAND

Sea level are rising

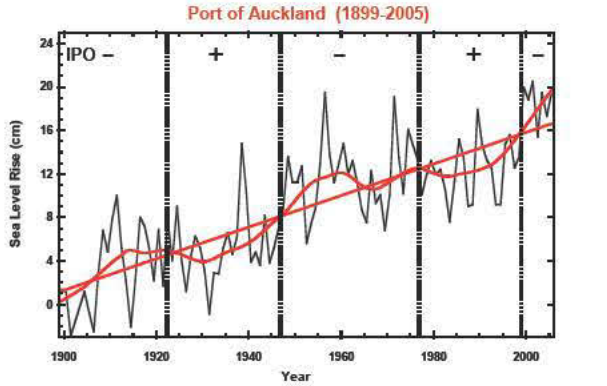


Sea level are rising



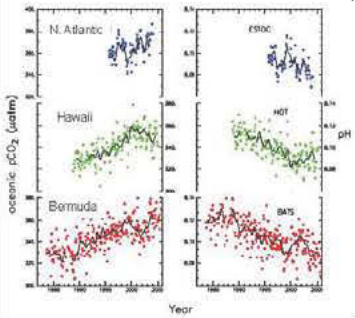
New data on past sea level rise (blue line and band) for the last 2000 years. It matches with tide gauge data (green) but shows some discrepancy with simple models (red). Source: Real Climate

Sea levels are rising



THE UNIVERSITY OF AUCKLAND NEW ZEALAND

Oceans are becoming more acidic



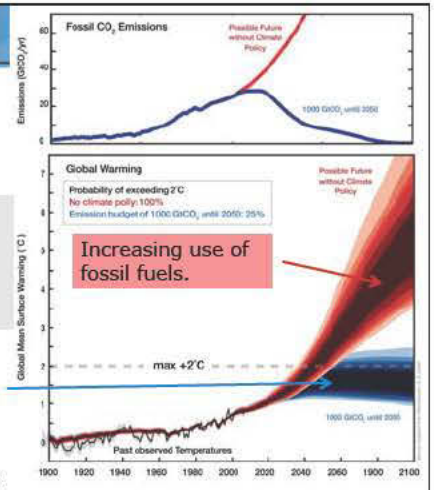
- 0.1pH unit decrease observed
- Another 0.3pH unit decrease this century
  - Unprecedented for over 20 million years
- Affects corals, shell formation, plankton growth
- May damage whole food chain in the oceans
  - **Regardless of "global warming"**

Future climate

We are at a Y-Junction for the future

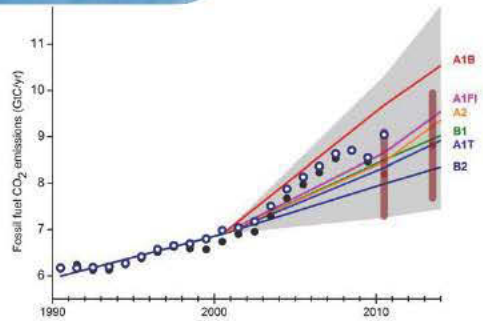
This is the critical decade. Decisions we make from now to 2020 will determine the severity of climate change our children and grandchildren experience.

Rapid development of new technology and halving greenhouse gas emissions by 2050.



Malte Meinshausen et al, Nature, 2009

Current fossil fuel emissions

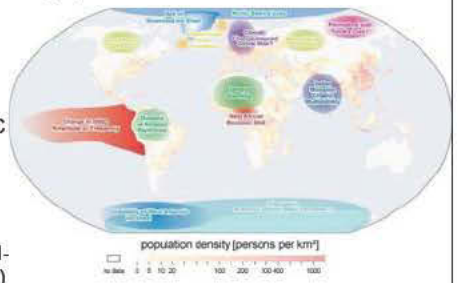


Global fossil fuel CO_2 emissions. Dots show estimates from US EPA (1990 to 2009) and BP (1990 to 2010). Coloured lines show the marker scenarios for emissions used in climate models for the last two IPCC assessment reports and the grey band shows the full range of these SRES scenarios. The two vertical bars in 2010 and 2013 show the range of emissions covered Pathways being used for the next IPCC assessment.

Future climate

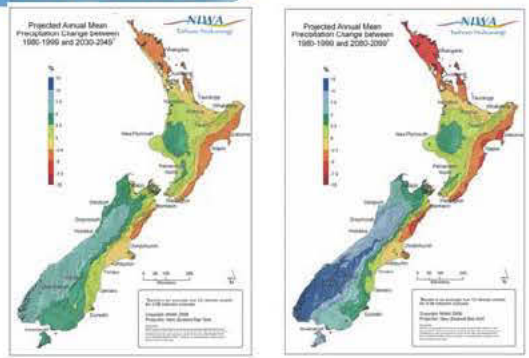
Climate tipping points

- West Antarctic ice sheet 2–4 °C
- Greenland 1–2 °C (above 1980–1999)
- Arctic sea ice 0.5–2 °C (above 1980–1999)
- Boreal forest 3–5 °C (above 1980–1999) (dieback etc)
- Continental glaciers 1-3 °C (above 1980–1999)



- Safe Level of CO_2 ~ 350 ppm
- Multiple benefits of bolution

Future climate



- By 2030s 1.0°C warmer, less frost
- By 2030s wetter in the west, drier in the east

Future climate

Location	Summer	Autumn	Winter	Spring	Annual
2040s					
Tasman – Nelson Deg C	1.0 [0.2, 2.2]	1.0 [0.2, 2.3]	0.9 [0.2, 2.0]	0.7 [0.1, 1.8]	0.9 [0.2, 2.0]
Nelson %	4 [–14, 27]	5 [–2, 19]	1 [–4, 9]	0 [–8, 9]	2 [–3, 9]
2090s					
Tasman – Nelson Deg C	2.2 [0.9, 5.6]	2.1 [0.6, 5.1]	2.0 [0.5, 4.9]	1.7 [0.3, 4.6]	2.0 [0.6, 5.0]
Nelson %	6 [–13, 30]	5 [–4, 18]	6 [–2, 19]	–1 [–20, 19]	4 [–3, 14]

Source NIWA

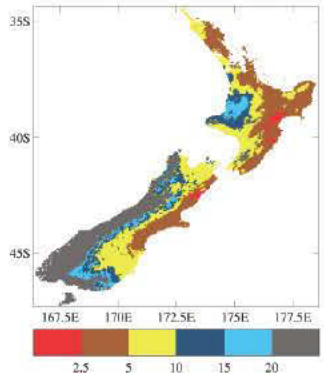
Drought

Dominion Post

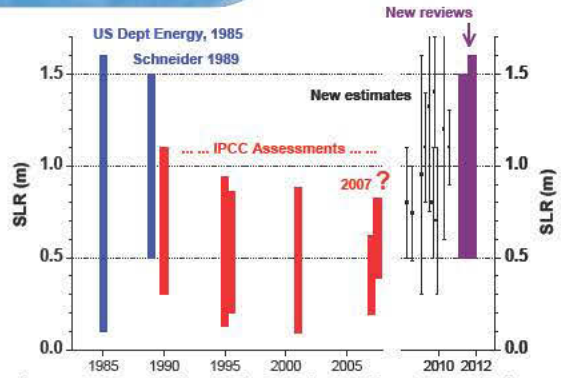
Drought: Nelson

1-in-20 year drought becomes 1-in-10 (extreme scenario)

2080's drought frequency (years) For present 1-in-20 year event



Future sea level 2100



Sea level rise estimates have changed significantly in the last 3 years

New Zealand Climate Change Research Institute
Te Pūtahi Kiurihanga Tairāo

Impacts

- More drought reducing production
- Longer growing seasons, less frost risk
- Sea-level rise likely to exacerbate ocean storm surge damage
- Will cause coastal inundation, erosion, loss of wetlands, salt water intrusion, beach erosion
- Design criteria for extreme events more frequently exceeded
- Increased inundation of transport structures (roads, rail, bridges)
- Failure of flood plain protection and urban stormwater systems



Mitigation

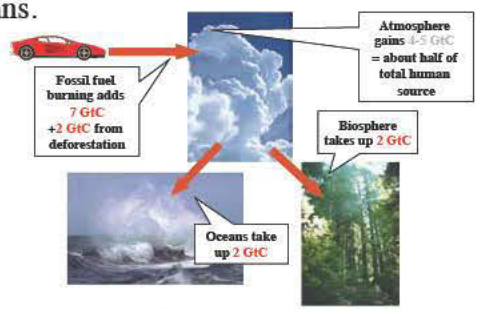
- Anti-methanogen vaccines
- Chemigenomics / inhibitors for methane production
- Animal selection & breeding
- Ruminant nutrition – forages and dietary manipulation
- Low greenhouse gas emitting farm systems through dietary manipulation, management of nitrogen inputs etc
- But keeping coal in the ground is far more important!


Summary

- Temperatures 6 C & sea levels 120 m lower 20,000 years ago
- More greenhouse gases warm the climate
- Carbon dioxide 38% higher than pre 1750 & rapidly rising
- Temperatures and sea levels are rising, extremes increasing
- Less frosts are occurring, glaciers and sea ice shrinking
- At a critical point in carbon emissions for the future
- Temperatures and sea level will rise significant this century
- Impacts will occur, and mitigation options available for agriculture eventually

What the sceptics say...and why they're wrong

1. The Earth's climate is always's change and nothing to do with humans.



Fossil fuel burning adds over 100 times more CO_2 to the atmosphere than volcanoes do

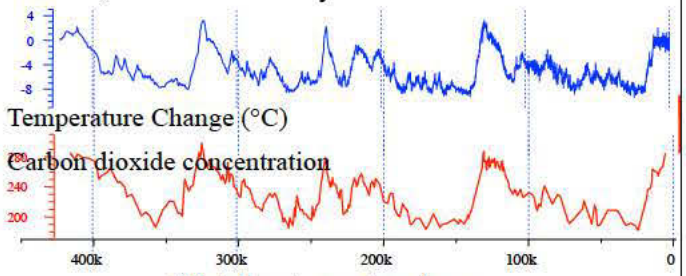
What the sceptics say…and why they're wrong

2. CO_2 is only small part of the atmopshere so can't be responsible for global warming

- Greenhouse gases, such as carbon dioxide, strongly absorb heat – other gases in the air don't.
- Water vapour is also a greenhouse gas.
- Before industrialization carbon dioxide concentration in the air was 280 ppm, now it is 390 mm.

What the sceptics say…and why they're wrong

3. Rises in CO_2 in the air are a result of temperature increases, not the other way round

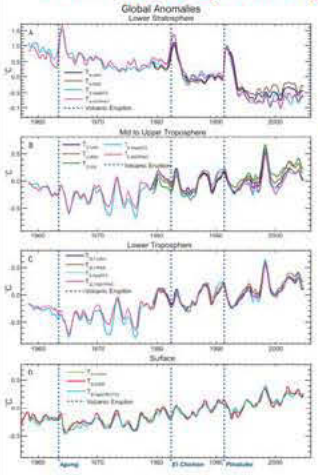


CO_2 follows temperature change

- Sure, but vice-versa too: a feedback loop

Date (1000s of years before present)

What the sceptics say…and why they're wrong



4. Observations taken by weather balloons and satellites do not support global warming

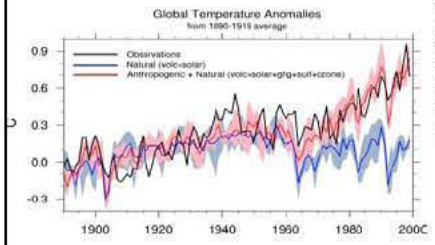
– Latest estimates agree nicely

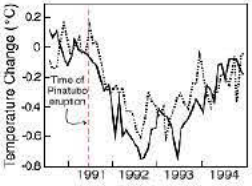
- NOW they show warming!

AR4 WG1 Fig 3.17

What the sceptics say…and why they're wrong

5. Computer models which predict future climate are unreliable and based assumptions.





Source: Hansen et al. GRL

What the sceptics say…and why they're wrong

6. It's all to do with the Sun – e.g there is a strong link between global temperatures and sunspots.

Solar

- small trend cycles of ± 0.1ºC
- solar radiation has only varied by 0.1%

What the sceptics say…and why they're wrong

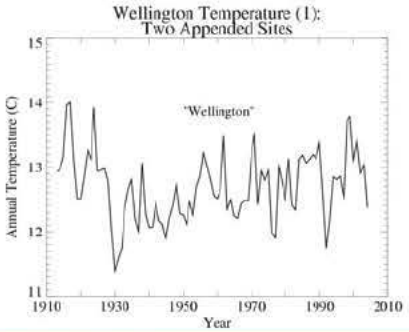
7. The climate is actually affected by cosmic rays.

The science says no!

Dr Jim Salinger, 18 August 2009

What the sceptics say…and why they're wrong

8. Adjusting temperature series

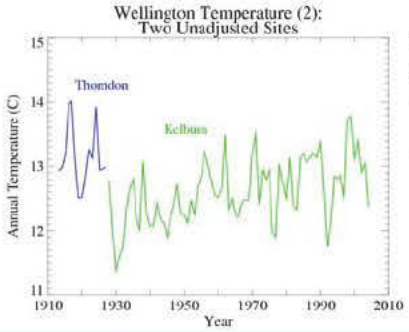


Annual Temperature Series
1) "Wellington"

Spot the TREND!

What the sceptics say…and why they're wrong

Adjusting temperature series



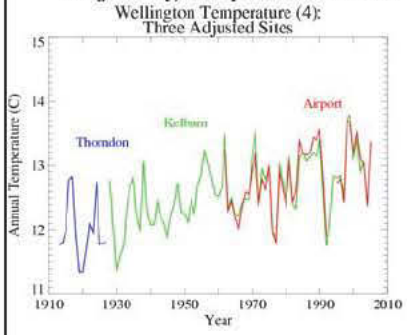
Annual Temperature Series
2) As (1) but …

- **2 sites distinguished by colour**
- **Line joining data from different sites removed**

Thorndon: 3 m. asl
Kelburn: 125 m. asl

What the sceptics say...and why they're wrong

Adjusting temperature series



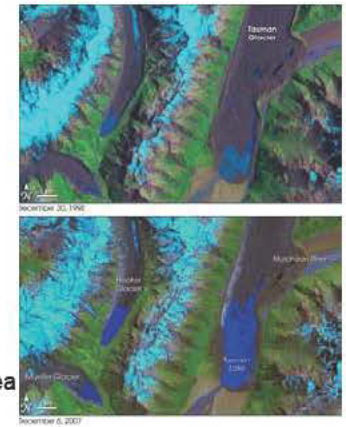
Annual Temperature Series
3) As (2) but …

- **Altitude adjustment to Thorndon, and airport**

See the trend now?

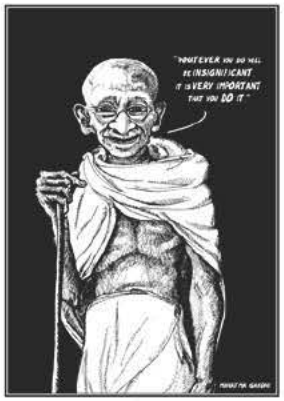
Concluding remarks

- Increases in greenhouse gases are causing the climate system to warm
- Observations show unequivocal warming of the climate system
- New Zealand temperatures have warmed at least 0.8°C in the last 100 years
- There has been a lot of ice mass loss, and some rise in sea level



Concluding remarks

- Impacts of warming so far include massive reduction in ice volumes, melting of Arctic permafrost, earlier emergence of insects, birds and plants in spring, retreat of New Zealand glaciers and southward spread of subtropical grasses
- Sea level rise likely to be much more than projected in 2007



Rod Oram's presentation
Nelson, August 3rd, 2011

Reinventing Paradise

Responding positively to climate change

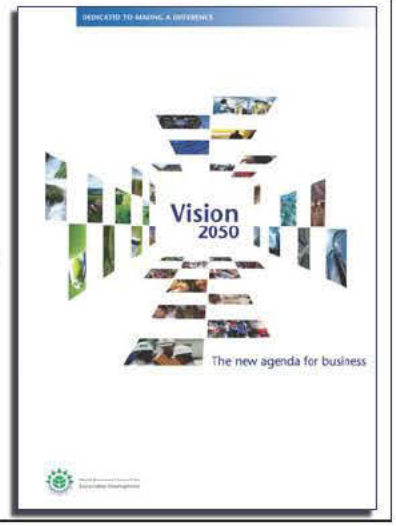
Agenda

- What's up?
- Why us?

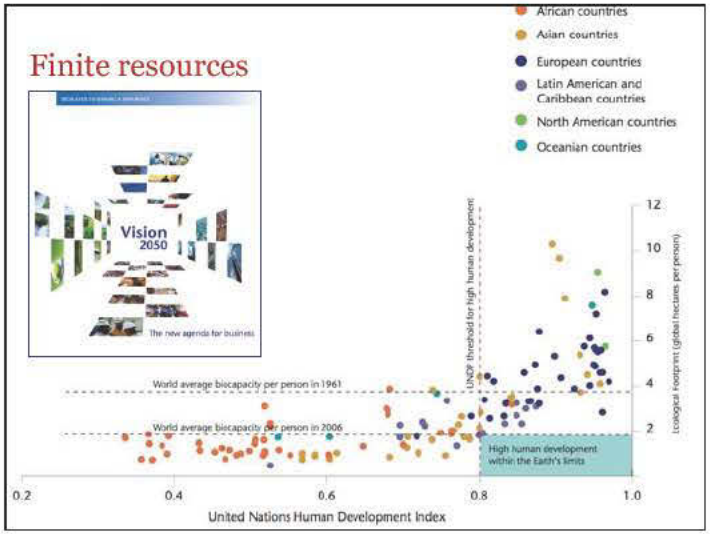
- Our response
- Our advantage

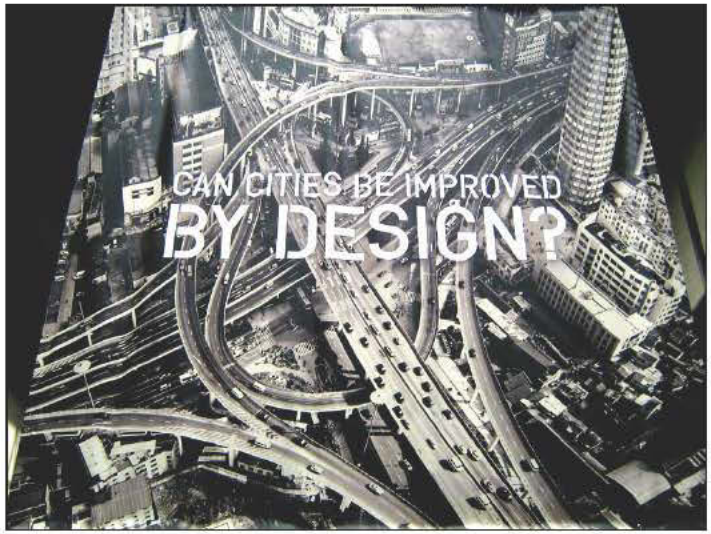
The great challenge

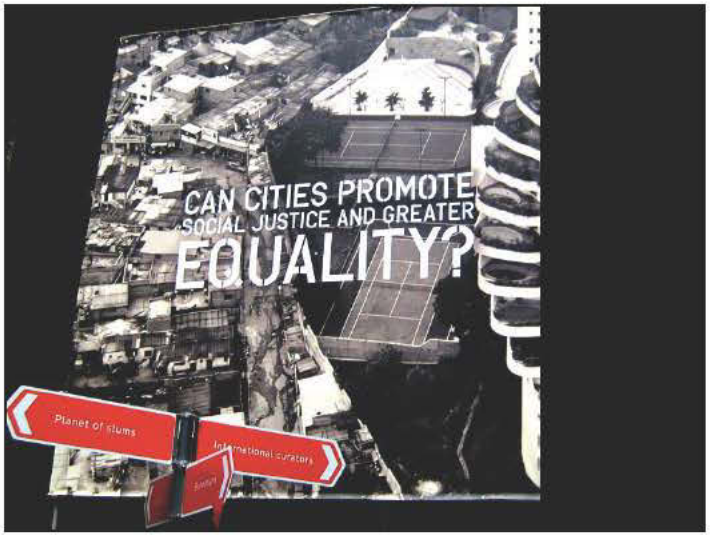
- People, planet
- Vision 2050
- A very challenging roadmap for ecological, societal and economic development
  - World Business Council for Sustainable Development

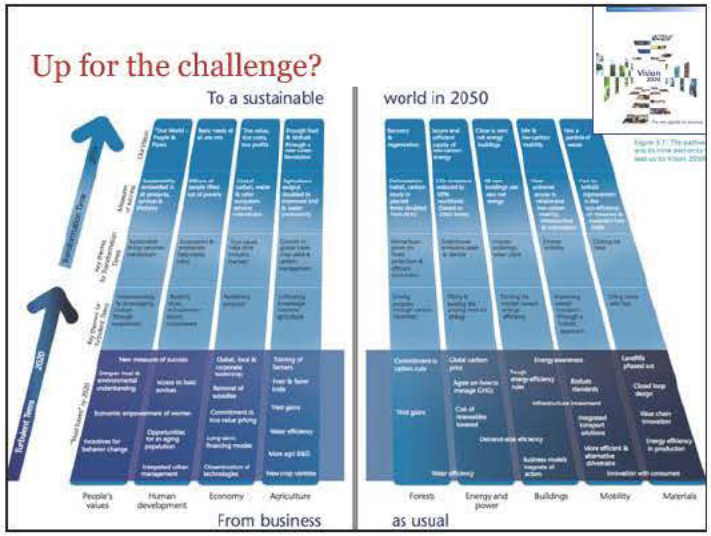


Finite resources



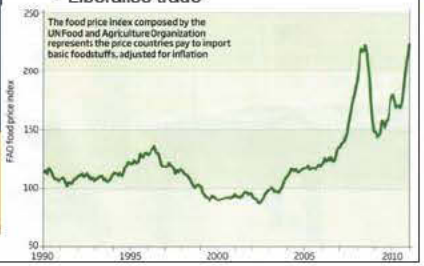


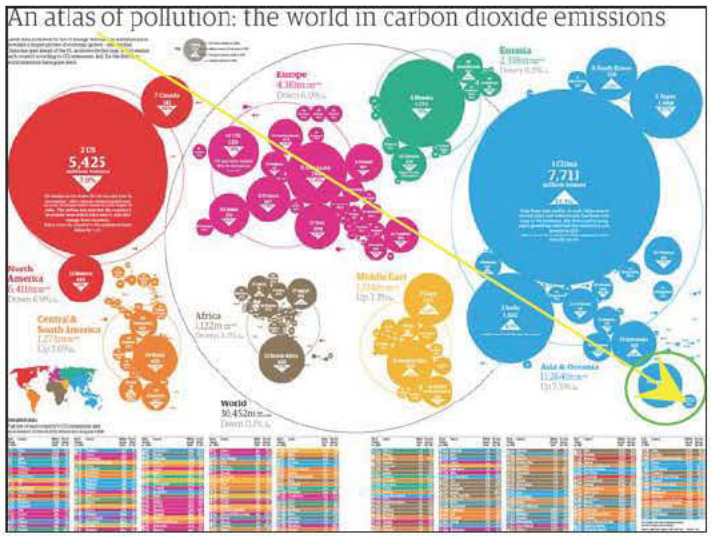




Food and water

- 50% increase in world food production by 2030…100% by 2050, UN says
- "The underlying problem is the decline in agricultural productivity. Unless we reverse that, we'll be back in the same situation in a few years time."
- The world needs to:
  - Ramp-up science
  - Invest in farming
  - Liberalise trade





Agenda

- Why us?
- **Why us?**

- Our response
- Our advantage

Why New Zealand?

- Our environment matters:
  - Of all OECD countries, we're the most dependent on our natural environment for earning our living
  - Environmental integrity and brand are vital to earning that living
- Our resources are thin:
  - We are a very, very small, thinly resourced, open economy
  - …we have few people, limited capital
  - We have to innovate fast and efficiently, in business and government
  - E.g .world's first independent Central Bank; fiscal responsibility act
- We think and act globally to create opportunities…e.g.:
  - World Trade Organisation; sponsoring China's admission; first FTA
  - WTO agricultural negotiations
  - UN in general…
  - …UNFCCC in particular, e.g. on agriculture and forestry
  - …Kyoto chairman is Adrian Macey, a NZ diplomat

How we – and others – brand NZ overseas

Whole Foods' flagship store, London


Whole Foods,
Whole People,
Whole Planet

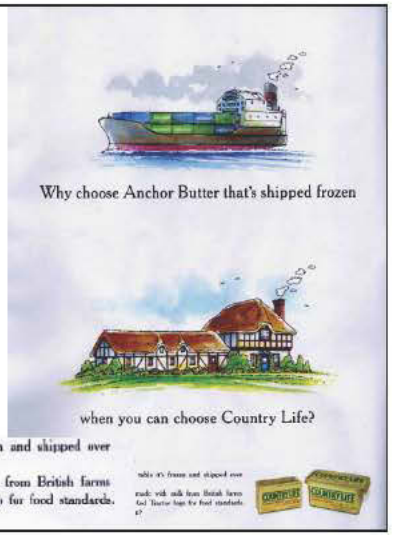

PROVISION MARKET


green
We choose recycled, renewable and sustainable resources and make alternative energy the right choice.
WHOLE PLANET FOUNDATION
Our mission is to create economic partnerships with the poor in developing world communities who supply our stores.
WHOLE TRADE GUARANTEE
Certification Partnership Program Guarantees:
• Fair Price
• Labour Welfare
• Sustainable Environment
• Quality
Animal


Marks & Spencer: Plan A on sustainability
Help
Wish List
Quick order
M&S
Plan A
DOING THE RIGHT THING
Online Shopping
Store Finder
Plan A is all about doing the right thing
Where do all the pennies go?
About Plan A
We launched Plan A in January 2007, setting out 100 commitments to achieve in 5 years. We've now extended Plan A to 180 commitments to achieve by 2015, with the ultimate goal of becoming the world's most sustainable major retailer.
Through Plan A we are working with our customers and our suppliers to combat climate change, reduce waste, use sustainable raw materials, trade ethically, and help our customers to lead healthier lifestyles. Explore our Plan A commitments for 2010 - 2015.
We're doing this because it's what you want us to do, it's also the right thing to do. We're calling it Plan A because we believe it's now the only way to do business.
There is no Plan B.

An ad...

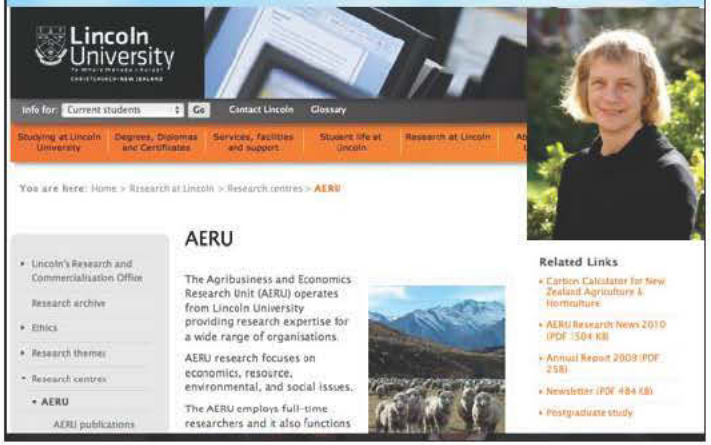
- Dairy Crest launched a $20m UK ad campaign in July 2006…
- …for Country Life butter
- …backed by the National Farmers' Union
- "Crimes of consumption"



New disciplines

- Measuring the environmental flows through a business
- E.g. Walkers' carbon management and labeling…
- …is a powerful business discipline, driving great efficiencies
- Transforming Walkers' business model, service delivery & relationships

Lincoln University...Prof. Caroline Saunders



What it means for us

- We cant feed the world (2% dairy)
- But need to maintain high value for products based on sustainability and help other countries with our technology
- But… to access high value markets need to assess attributes of product
- This includes being aware of market requirements and policy
- Assurance schemes can lead to win win situation for NZ

Our brand

- NZ does brand itself as Clean and Green
- 100% pure – used by tourism
- Other brands also important such as Zespri and Anchor
- Generally surveys overseas show positive reaction to NZ brand
- Need to maintain this to access high value premium markets

Lincoln University AERU

Risks and opportunities for exporters

- To access premium market segments have to consider sustainability including social & environmental factors
- Often these are defined by overseas markets
- We have to ensure these factors are defensible and not pseudo
- Food miles ignores production resource use

Food miles - fact & fiction

- Vital to analyse energy consumption across the entire production and distribution chain
  - NZ production is relatively low-energy
  - NZ transport to market is low-energy
  - We need to know far more about our energy consumption
- UK Government report, July 2005:
- Of all food miles:
  - 0.1% come from air transport
  - 0.04% come from sea transport to the UK
  - 40% from truck transport in the UK
  - 50% come from consumers driving to supermarkets

Sustainability & market access issues

- Carbon Footprinting
- Local food and seasonal consumption
- Lower meat and dairy consumption
- Ethical food - fair trade and organic!
- Biodiversity and wildlife
- Water quality and quantity
- Ageing Population
- Food waste

Dairy: NZ vs. UK

- Lincoln's analysis:

- NZ uses under half energy than the UK does
- Even despite not being able to obtain as detailed data on UK capital inputs
- Even when methane and nitrous oxide included…
  …the UK produces 34% more GHG emissions per kgMS
  …and 30% more per ha

Lamb greenhouse gases – NZ vs. UK

Item	Energy MJ/Tonne carcass		CO_2 Emissions kg CO_2/Tonne carcass	
	NZ	UK	NZ	UK
Direct sub total	4,158	17,156	256	1,117
Indirect sub total	3,698	27,452	241	1,607
Capital sub total	731	1,251	66	125
Total Production	8,588	45,859	563	2,849
Shipping NZ to UK (17,840 km)	2,030	-	125	-
Total Production Energy Input/Emissions	**10,618**	**45,859**	**688**	**2,849**

Dairy greenhouse gases – NZ vs. UK

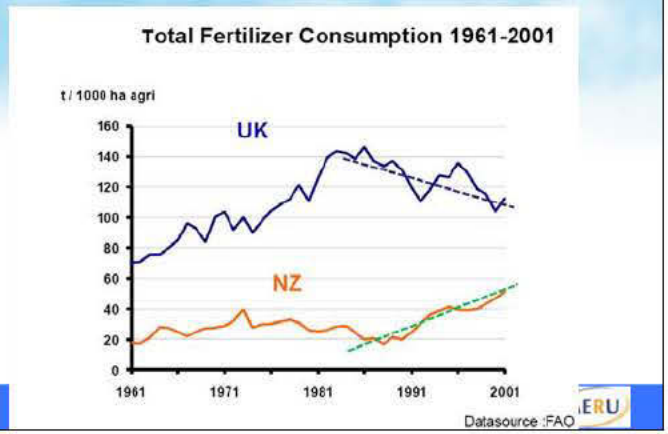
Item	GWP_{100} kg CO_2 equivalent/ha		GWP_{100} kg CO_2 equivalent/kgMS	
	NZ	UK	NZ	UK
Energy	1,145	2,825	1.37	3.47
Methane	5,780	5,310	6.63	6.52
Nitrous Oxide	3,150	3,655	3.66	4.49
Total Emissions (85% allocation to milk)	8,585	10,020	9.89	12.31
Total Emissions (100% allocation to milk)	**10,080**	**11,790**	**11.61**	**14.49**

Greenhouse gases: Lincoln Uni vs. 'typical' farm

Table 1 Carbon Footprint of the LUDF vs. a "Typical" NZ Dairy Farm

	Carbon Footprint ($kgCO_2eq$/t MS)		Carbon Footprint ($kgCO_2eq$/ha)		Carbon Footprint ($kgCO_2eq$/cow)	
	Lincoln Uni. Dairy Farm	Typical NZ Dairy Farm	Lincoln Uni. Dairy Farm	Typical NZ Dairy Farm	Lincoln Uni. Dairy Farm	Typical NZ Dairy Farm
Direct Energy	380	360	755	375	185	135
Indirect Energy	730	780	1,455	815	350	290
Capital	50	140	105	145	25	50
Methane	4,770	5,570	9,510	5,805	2,300	2,070
Nitrous Oxide	2,950	3,070	5,875	3,200	1,420	1,140
Total	**8,875**	**9,920**	**17,700**	**10,340**	**4,280**	**3,690**

But the gap's closing



Local food and seasonal consumption

- Growing demand for local food
- UK and US government promoting local food and food miles! (sausages from supermarket would have to travel 227,727 miles to have same footprint as those from local shop)
- Growth in local farmers markets, box schemes ect.
- Seasonal consumption also may not be better for the environment
- Also consider wider sustainability implications
- Choice editing

Lincoln University AERU

Lower carbon diets: meat and dairy

- Demand for reduction in meat and dairy consumption (livestock 18% of worlds total)
- 'Meat free Monday' Paul McCartney
- Ghent – meat free one day a week
- WWF meat should be labelled 1-3 times a week max
- NHS – reducing meat and dairy in diets
- Demand for reduction in meat and dairy consumption
  - Livestock 18% of worlds total
- Research shows that dairy based diet not much different from vegan diet for emissions (6%)
- Meat based diet more emissions (23% more)
- Further research into alterative sources of supply for meat and its by products

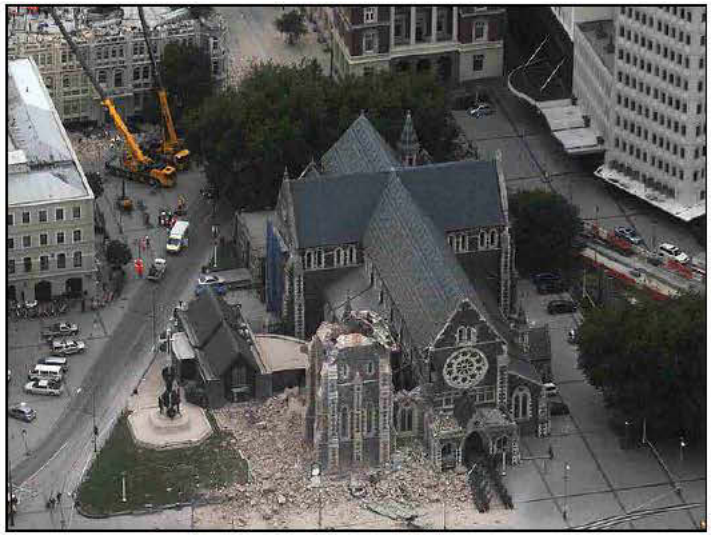
Lincoln University AERU

Conclusions

- Threats to trade changing from regulatory…
  …to 'access-to-market from retailers'
  - This has been developing over time
  - Carbon footprints are an example of this
  - Not just EU markets it is spreading elsewhere

- = Win-win for NZ farmers:
- Better returns for exports & more sustainable production

Lincoln University AERU



Agenda

- What's up?
- Why us?

- **Our response**
- Our advantage

Role of NZ government – overseas

- **Global Research Alliance on Agricultural Greenhouse Gases**
- Proposed by NZ government at Copenhagen in 2009…to:
  - Reduce emissions; increase food production
  - Help developing countries to join global climate change frameworks

- Alliance now has 36 countries + 3 observers including the EU
  - = 70% of global agricultural GHGs; agriculture = 15% of total GHGs

- Three main workgroups:
  - Livestock, led by NZ and Netherlands, 483 projects identified to-date
  - Croplands, led by US, 429 projects to-date
  - Paddy Rice, led by Japan, 60 projects to-date
  - Secretariat: NZ
- Ministerial Summit in June

- What in means to NZ:
- Bedrock science for us; our biggest international science collaboration
- Government has committed NZ$45m over four years 2010-13

Business engagement

- After years of scepticism, engagement is growing
- Some leaders emerging, e.g.
  - Fonterra in the dairy sector
  - Air New Zealand
  - Zespri in kiwifruit
  - Mighty River, Meridian and Contact in renewable electricity
  - NZ Post in transport
- Investment in renewable electricity accelerating
- Some fuel switching e.g. from coal to wood chips in industrial plants
- But generally speaking, if companies aren't directly engaged in the ETS as "points-of-obligation", then many tend to ignore even basics such as energy and fuel efficiency audits, improvements
- Clean tech activity still very modest
  - …tho some outstanding individual companies and investors

Zespri

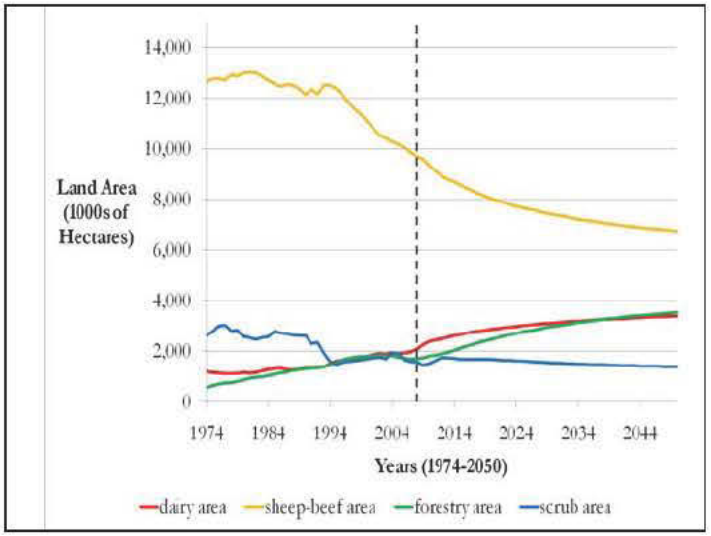
- April 2009: Published its carbon life cycle analysis:
  - Orchard operations make up 17% of total emissions for EU exports
  - Packhouse & coolstore processes account for 11% of total emissions
  - Shipping accounts for 41% of total emissions
  - Repacking and retailer emissions amount to 9% of total emissions
  - Consumer consumption & disposal comprises 22% of total emissions
  - Bottom line: resource efficiency builds a more profitable, resilient business
  - E.G. Kite-assisted ships save 22% of their fuel bills on average

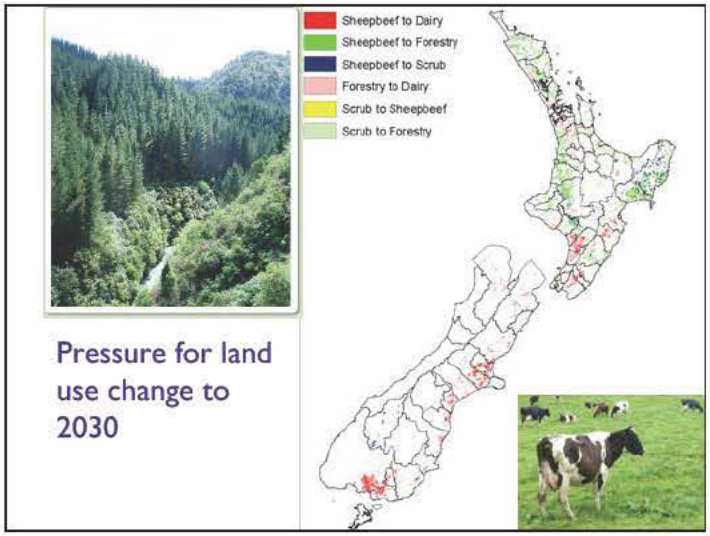
Zespri

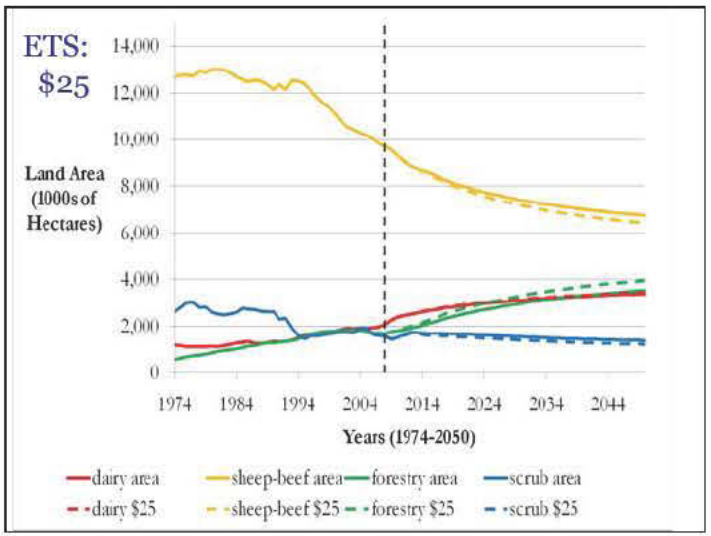
- Established brand
- Built marketing
- Innovated – gold
- Innovated – orchards
- Innovated – intellectual property
- Clever, 12-month supply chain
- *Result?*
- 40% - 100% premium in EU
- …and lots more science yet

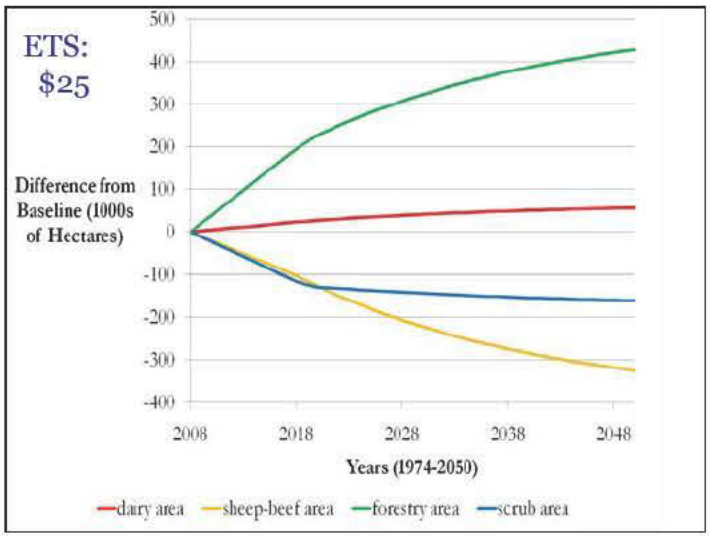
From exporter to global leader…

…decommoditising a commodity


14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Land Area (1000s of Hectares)
1974
1984
1994
2004
2014
2024
2034
2044
Years (1974-2050)
dairy area
sheep-beef area
forestry area
scrub area

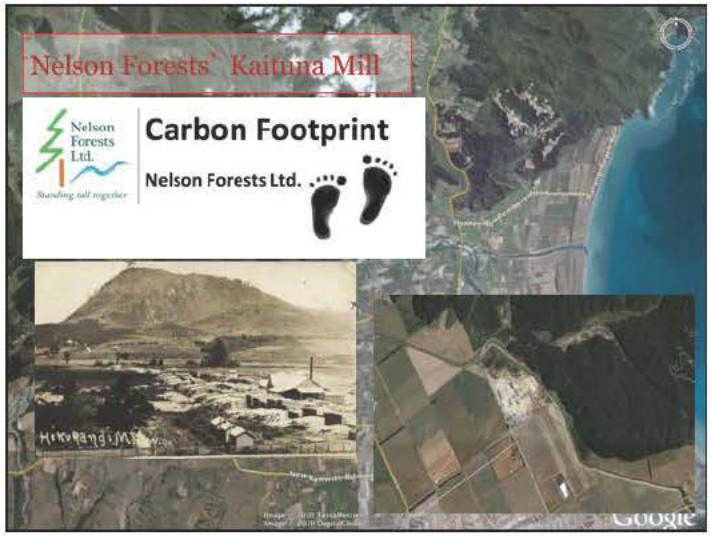

Sheepbeef to Dairy
Sheepbeef to Forestry
Sheepbeef to Scrub
Forestry to Dairy
Scrub to Sheepbeef
Scrub to Forestry
Pressure for land use change to 2030


ETS: $25
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Land Area (1000s of Hectares)
1974
1984
1994
2004
2014
2024
2034
2044
Years (1974-2050)
dairy area
sheep-beef area
forestry area
scrub area
dairy $25
sheep-beef $25
forestry $25
scrub $25


ETS: $25
500
400
300
200
100
0
-100
-200
-300
-400
Difference from Baseline (1000s of Hectares)
2008
2018
2028
2038
2048
Years (1974-2050)
dairy area
sheep-beef area
forestry area
scrub area

Forestry engagement

- Forest owners suffered great turmoil because of policy indecision, shifts by last government
  - Impact included virtually no new planting; heavy deforestation
- Much more policy stability now
  - Impact includes big pick up in planting
  - Notably, some sales of Kyoto forest credits to overseas buyers
- But big issues still to be resolved, e.g:
  - For small forest owners, decision whether to opt in or out of the ETS is a big one
  - Uncertain future for permanent forest sinks
  - …likewise, international negotiations on forestry rules
- New Zealand remains very dependent on its Kyoto forests for minimising its Kyoto obligations
- This is a short-term strategy; doesn't solve long term emissions, mitigation & adaptation; policy and action still inadequate on those issues



Farming engagement

- Dairy exports are NZ's largest source of foreign exchange (about 25%)
- Dairy farming is NZ's largest industrial GHG emitter (about 40%)
- Dairy sector is NZ's largest export conundrum
  - Can it grow volume and value strongly?
  - Can it do so in environmentally responsible ways?
  - Can it compete against low-cost farmers overseas?
- Sheep & beef farmers have the same issues
- Federated Farmers is the fiercest ETS critic
  - Focuses only on cost and competition…not on opportunities
  - Sceptical about climate change, worries about economic impact
- Strong countervailing voices e.g. Fonterra
- Government is taking reasonably firm line with FedFarmers
  - …pushing the benefits of the ETS, science, int'l engagement

The road to sustainable dairy farming

- The International Dairy Federation began locking on to climate change issues a few years ago
  - Leaders within it include Fonterra, exporter of 90% of NZ's milk… and David Homer, an IDF board member and UK dairy farmer
- The IDF's 2010 World Dairy Summit was in Auckland last November
  - 2,250 delegates from 30 countries
  - Sustainable dairy farming was one of the conference streams
  - …attended by 250 farmers and scientists
  - …upbeat assessment of science, environment & business opportunities
  - Some of the delegates responses follow…

Is human activity contributing to global climate change?

1 Yes 95%

2 No 4%

3 Don't know 1%

Is dairy farming contributing to global climate change?

1 Yes 75%

2 No 17%

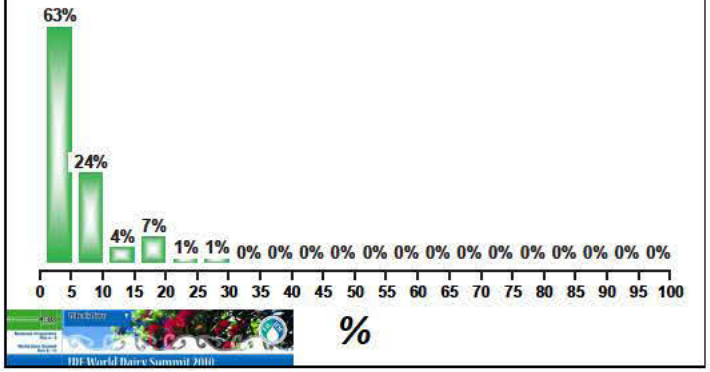
3 Don't know 8%

From what you've heard today, is dairy farming part of the climate change solution?

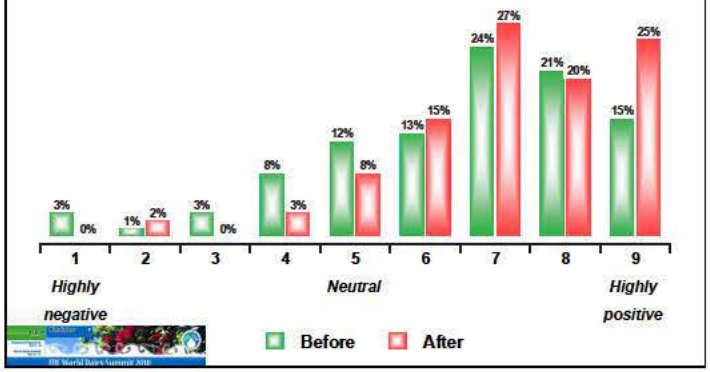
1 Yes 85%

2 No 15%

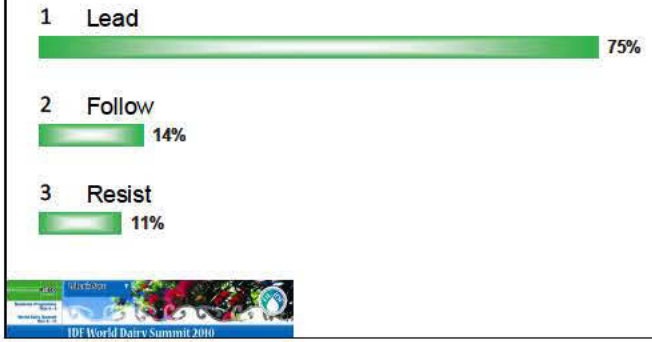
As a consumer, how much more are you prepared to pay in percentage terms if you know the products you purchase are sustainably produced?



How do you rate sustainability as a driver in your farming business?



Will you...



NZ Agricultural Greenhouse Gas Research Centre

- New ways of working
- …on science; on collaboration, NZ and globally
- …on engaging with farmers

Pastoral Greenhouse Gas Research Consortium
- Since 2002, 50/50 government and industry
- $30m investment in science so far

- NZ Agricultural Greenhouse Gas Research Centre
- Opened March 2010; $48.5m funding next 10 years
- Four main workstreams…$15.6m committed 2010-14
- Mitigate methane; mitigate nitrous oxide; increase soil carbon; deliver farming solutions

Our opportunity

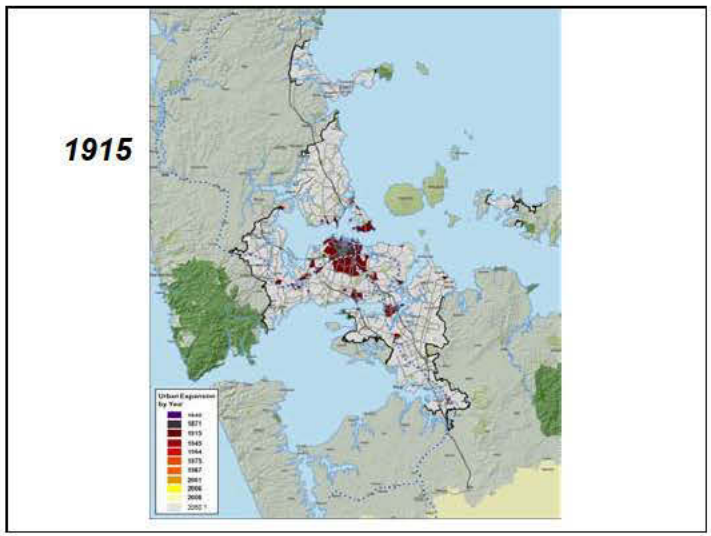
- 1 litre of milk = 940 gm of CO_2 equivalent
  - (According to the lifecycle analysis of milk by Fonterra, processor of 90% of NZ's milk, and a world leader in the global dairy trade)

16,000,000,000 litres = 15,040,000,000 kg of CO_2 eq

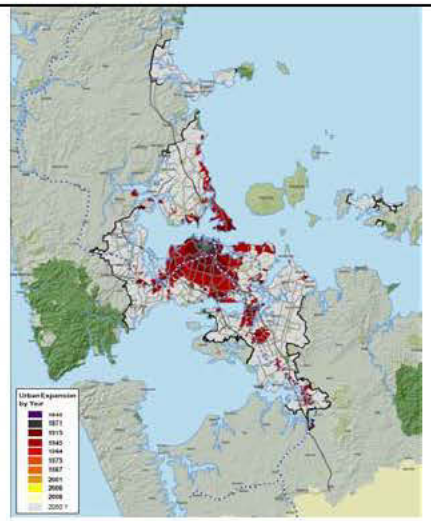
- 15.04m tonnes of CO_2 eq per year is not a waste product, or a liability

Helping animals digest their feed better so they produce fewer emissions, more energy would help close the nutrient cycle

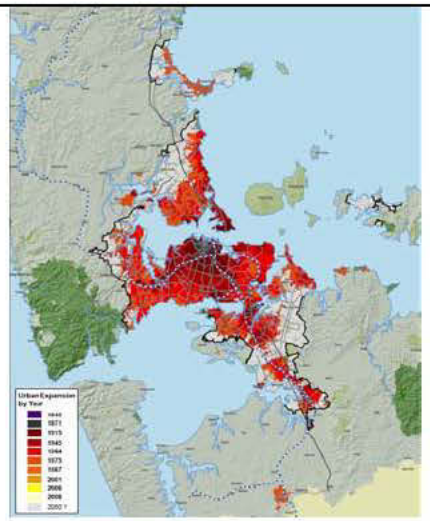
This a brilliant business opportunity…
healthier cows and soil…
= more food, better environment, bigger profits



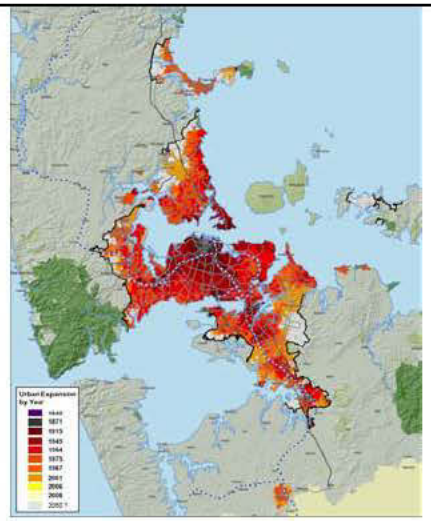
1945



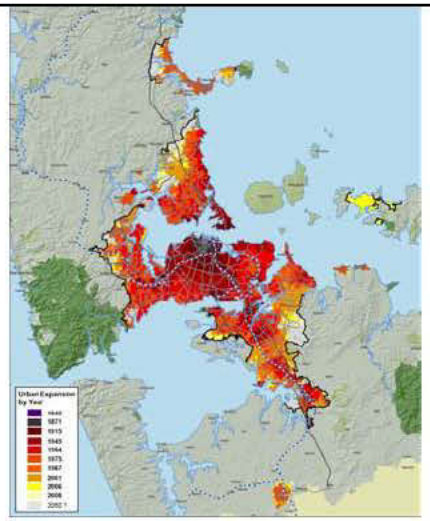
1975

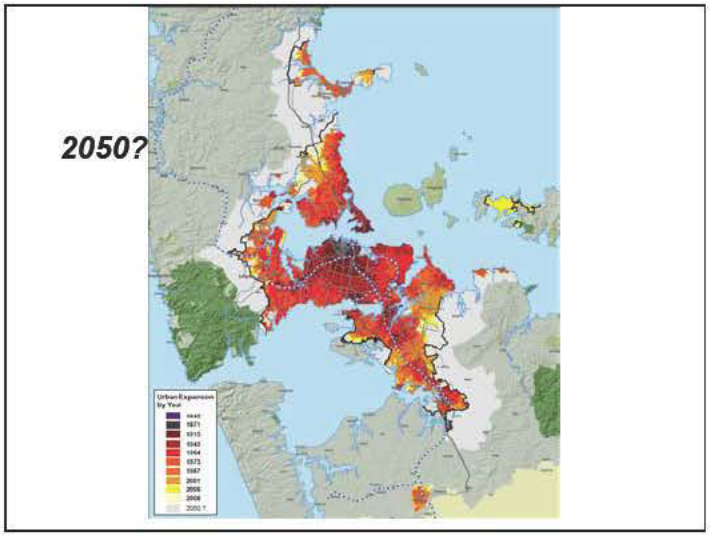


2001



2008



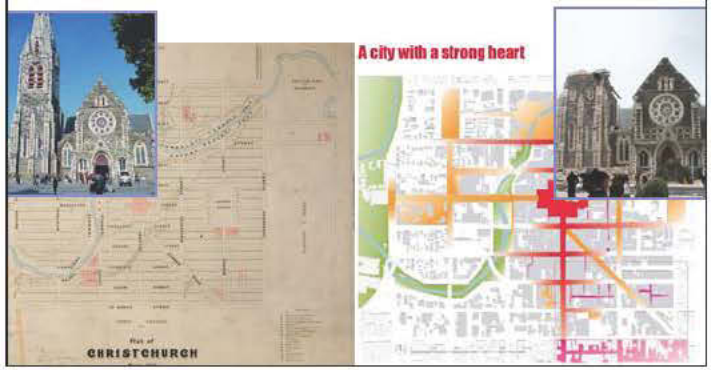


LanzaTech...clean tech leader

- Signed commercialisation agreements at the Shanghai World Expo last May with:
  - Chinese Academy of Sciences
  - Baosteel; next pilot plant in China
- Makes biofuel from industrial waste gases
  - Turns greenhouse gas liability into profit
  - World pioneer of the science
- Auckland-based; NZ Steel pilot plant
- Big venture capital backing
  - Latest round US$18m
  - NZ: Stephen Tindall
  - US: Vinod Khosla
  - China: Qiming Ventures

21st century Christchurch

- Opportunity to create the 21st Century Garden City



YikeBike: radical reinvention

- Grant Ryan' s radical re-think of the bike
- All-electric; no pedals; 10kg; 20 km/h; 10 km range; ABS brakes; regenerative braking; 45-minute recharge
  - Folds in 15 seconds; Guinness Book of Records

China produced 22m electric bikes last year

Community

- Issues are increasingly global….
- …solutions are increasingly local

- Solutions require very strong, learning communities

- Some attributes:
  - Common sense
  - Common purpose
  - Common wealth

- Places where individuals are valued, helped, encouraged

- …in return, they participate, change

- ***Challenge:***
- Helping communities articulate, visualise, realise their dreams

Cities – sex and age

"Every city has a sex and and age
which have nothing to do with demography.

Rome is feminine. So is Odessa.

London is a teenager, an urchin,
and, in this, hasn't changed since the time of Dickens.

Paris, I believe, is a man in his twenties in love with an older woman."

- *John Berger, "Imagine Paris', Harper's magazine, January 1987*

Agenda

- What's up?
- Why us?

- Our response
- **Our advantage**

Our advantage

- In a world where one product, one country looks ever-more like others...
- ...we stand out for our innovative, practical, leading approaches to issues
- An example:
- Our pavilion at the Shanghai World Expo last year was very distinctive
  - ...and in many lists of Top 10 "must see" pavilions
- Expo's theme: "Better City, Better Life"
  - China investing in new technology, materials, energy sources so many more people can enjoy higher living standards
  - Our pavilion featured NZ's very distinctive urban lifestyle
- In these sorts of ways, we're starting to reap the same rewards from responding constructively to climate change

...New Zealand

...will be

...what we make it