Solar Or Soy

Which is better for the planet?
(A review of animal agriculture's impact)

Handout for presentations by Paul Mahony in Melbourne, Australia on various dates during 2011 as at 16th June 2011

(Please print double-sided if possible)

Solar Or Soy

versus

versus

To the extent that solar power represents an alternative to coal, it is critical.

To the extent that soy represents an alternative to animal agriculture, it is also critical.

Key messages - General

Climate change is real

Human activity is having a massive impact

Key messages – Livestock

Inherent inefficiency

Scale

Greenhouse gases and other warming agents

Deforestation

Water

Nutrition

Also . . .

. . . it has to be part of the main game

Some terms

CO2-e: ***Carbon dioxide equivalent*** ***(see next slide)***

GHG: ***Greenhouse gas***

GWP: ***Global warming potential*** ***(see next slide)***

IPCC: ***Intergovernmental Panel on Climate Change***

Some terms (cont.)

CO2-e and GWP:

- The emissions of different gases can be aggregated by converting them to carbon dioxide equivalents (CO2-e). It is like a common denomination for greenhouse gases.
- They are converted by multiplying the mass of emissions by the appropriate global warming potentials (GWPs).
- GWPs represent the relative warming effect of a unit mass of the gas when compared with the same mass of CO2 over a specific period.
- For methane, the GWPs used by the UN's Intergovernmental Panel on Climate Change (IPCC) are 21 for 100 years and 72 for 20 years.
- The UN Food & Agriculture Organization used a GWP of 23 for the 100 year time horizon in its 2006 *"Livestock's Long Shadow"* report.

A sign of the times?
Brisbane, Australia, January 2011

Some of the fundamental science

- **There's no disagreement about the physics of radiative transfer and the fact that adding infra red absorbing gases to the atmosphere is going to make the atmosphere more opaque in the thermal spectrum, in the long waves.**
- **That will reduce heat radiation to space and if you reduce the radiation to space, given the fact that the amount of energy coming from the sun is unchanged, then you have to warm up the planet.**
- **You've got an energy imbalance and until the planet warms up enough to radiate that energy away, it's going to continue to get warmer.**
- **So the basic physics is very hard to dispute.**

Dr James Hansen, Director, Goddard Institute for Space Studies, NASA interviewed on Late Night Live, ABC Radio National (Australia), 8th March, 2010 and replayed 8th July, 2010.

It's real
Human impact

General

GHGs, sea levels and temperature

See next slide for more detailed image

- In less than 100 years, atmospheric concentrations of CO2 have increased to around 390 ppm, after never exceeding 300 ppm in the previous 1,000,000 years.

- Ice core data show that during the period of 425,000 years before the industrial revolution, there was a close correlation between atmospheric concentrations of carbon dioxide (CO2) and methane (CH4), temperature and sea level.
- In 1960, CO2 concentrations were around 315 ppm, so they have increased 75 ppm (24%) in 50 years.
- Prior to the start of the industrial revolution in around 1750, CO2 concentrations were approximately 280 ppm.
- For the period of human civilization before 1750 (around 10,000 years), CO2 concentrations, temperature and sea level were relatively stable.

Paul Mahony 2011

Sources: Hansen, J; Sato, M; Kharecha, P; Beerling, D; Berner, R; Masson-Delmotte, V; Pagani, M; Raymo, M; Royer, D.L.; and Zachos, J.C. *"Target Atmospheric CO2: Where Should Humanity Aim?"*, 2008. (This presenter has inserted the various overlays.)

http://www.columbia.edu/~jeh1/2008/TargetCO2_20080407.pdf and Hansen, J., *"Storms of my grandchildren"*, 2009, Bloomsbury

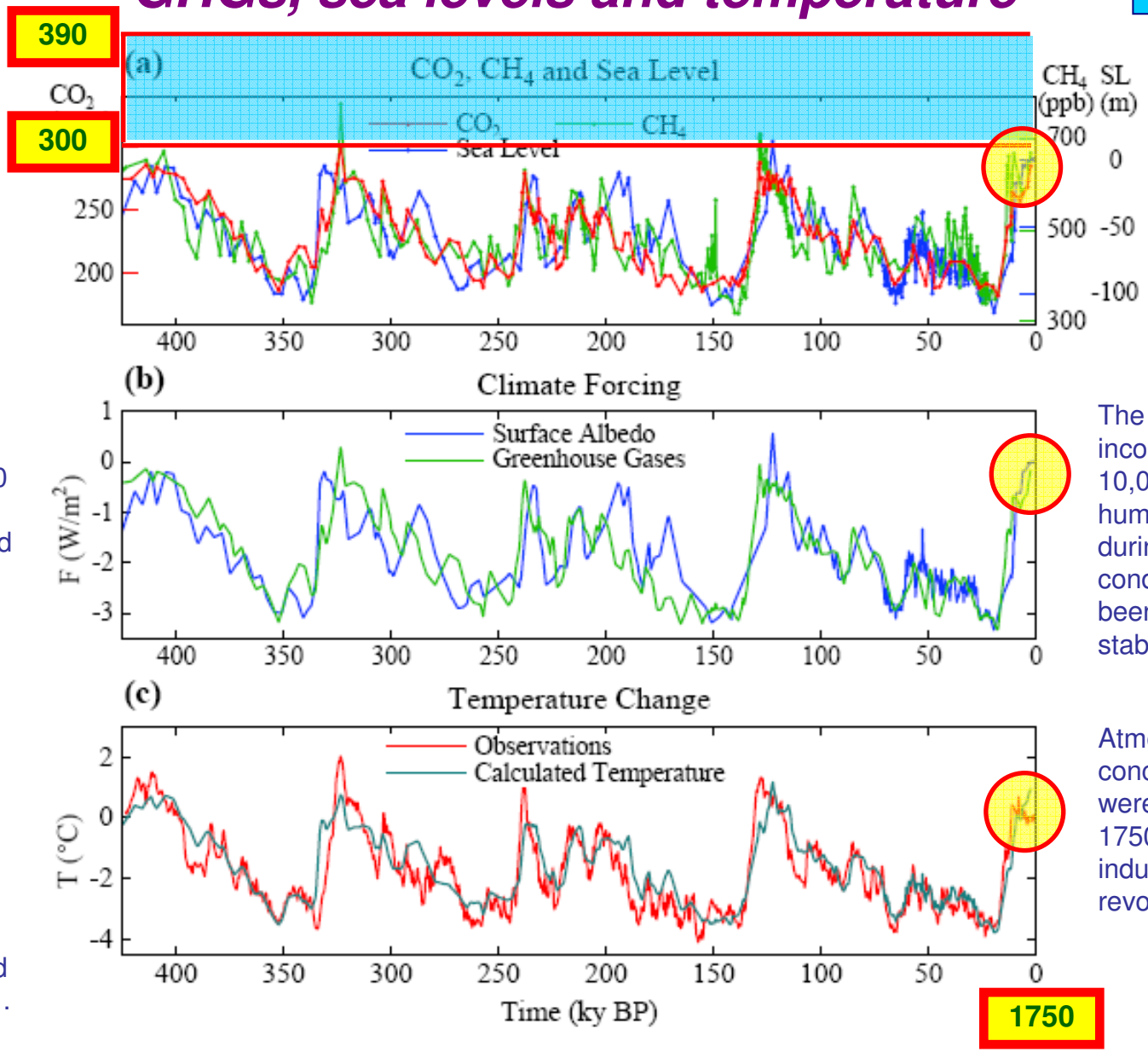
It's real
Human impact

GHGs, sea levels and temperature

General

Previous slide contains a simpler version.

Note the correlation between CO2 concentrations, temperature and sea level over a period of 425,000 years.
During that period (and during the past million years), except during the past 100 years, the atmospheric concentration of CO2 has not exceeded **300 ppm**. It has increased from around 315 ppm in 1960 to around **390 ppm** in 2011.



The shaded circles incorporate the 10,000 years of human civilization, during which conditions have been relatively stable.

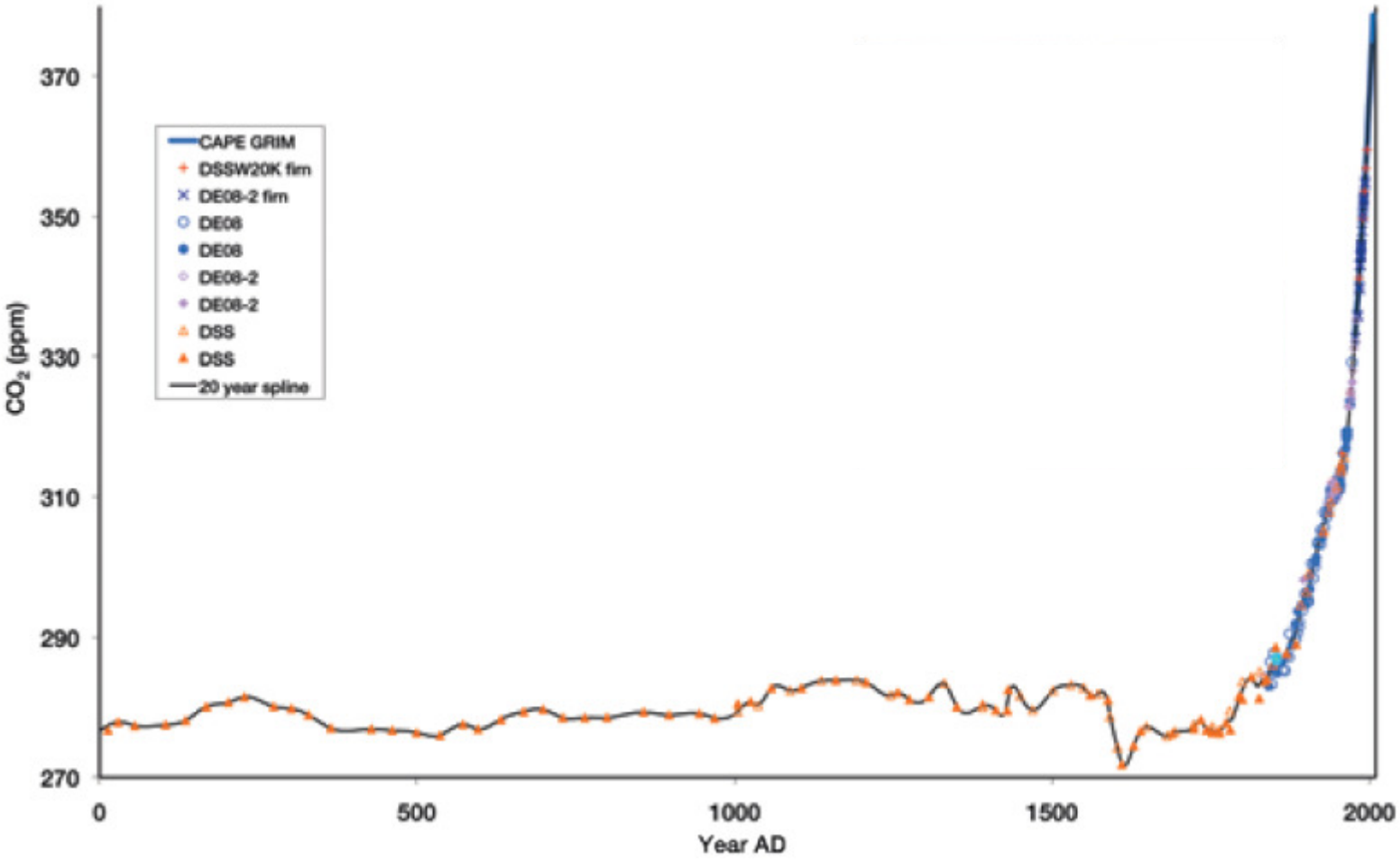
Atmospheric CO2 concentrations were **280 ppm** in 1750, before the industrial revolution.

Sources: Hansen, J; Sato, M; Kharecha, P; Beerling, D; Berner, R; Masson-Delmotte, V; Pagani, M; Raymo, M; Royer, D.L.; and Zachos, J.C. *"Target Atmospheric CO2: Where Should Humanity Aim?"*, 2008. (This presenter has inserted the various overlays.)

http://www.columbia.edu/~jeh1/2008/TargetCO2_20080407.pdf and Hansen, J., *"Storms of my grandchildren"*, 2009, Bloomsbury

A sign of the times?

Atmospheric CO2 over the past 2,000 years



Source: Adapted from CSIRO, *"The Science of Climate Change: Questions and Answers"*, Fig. 4.1, p. 10

A sign of the times?

Atmospheric CO2 over the past 2,000 years

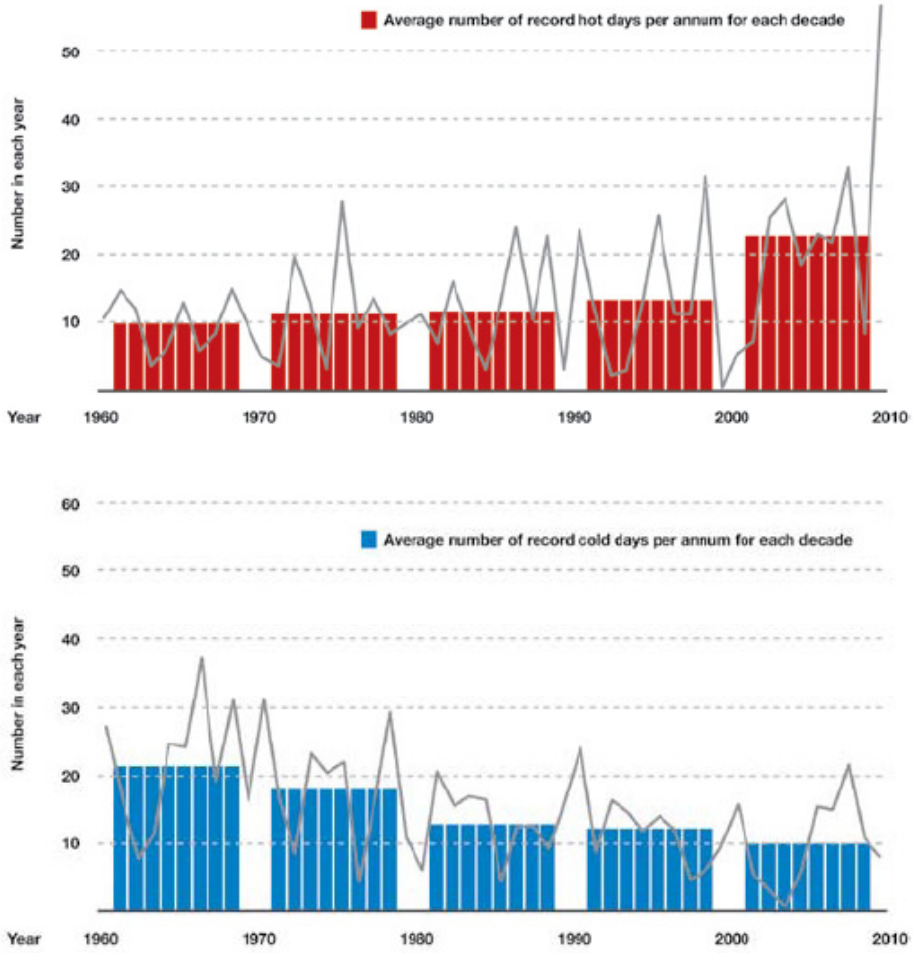
Are we in serious trouble?

You bet!

Source: Adapted from CSIRO, *"The Science of Climate Change: Questions and Answers"*, Fig. 4.1, p. 10

A sign of the times?

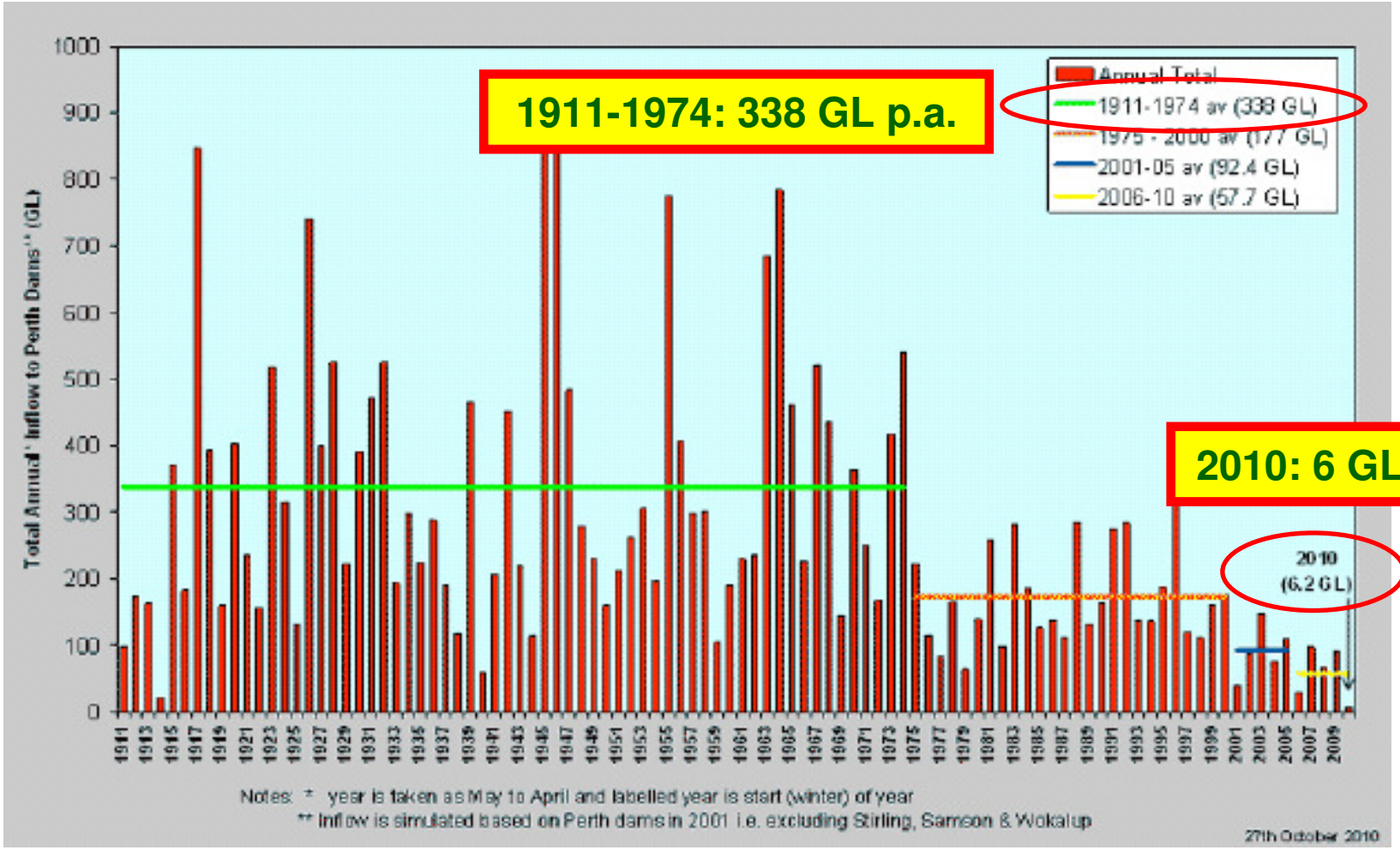
Record number of hot and cold days in Australia since 1960



Source: CSIRO, *"The Science of Climate Change: Questions and Answers"*, Fig. 3.3, p. 8

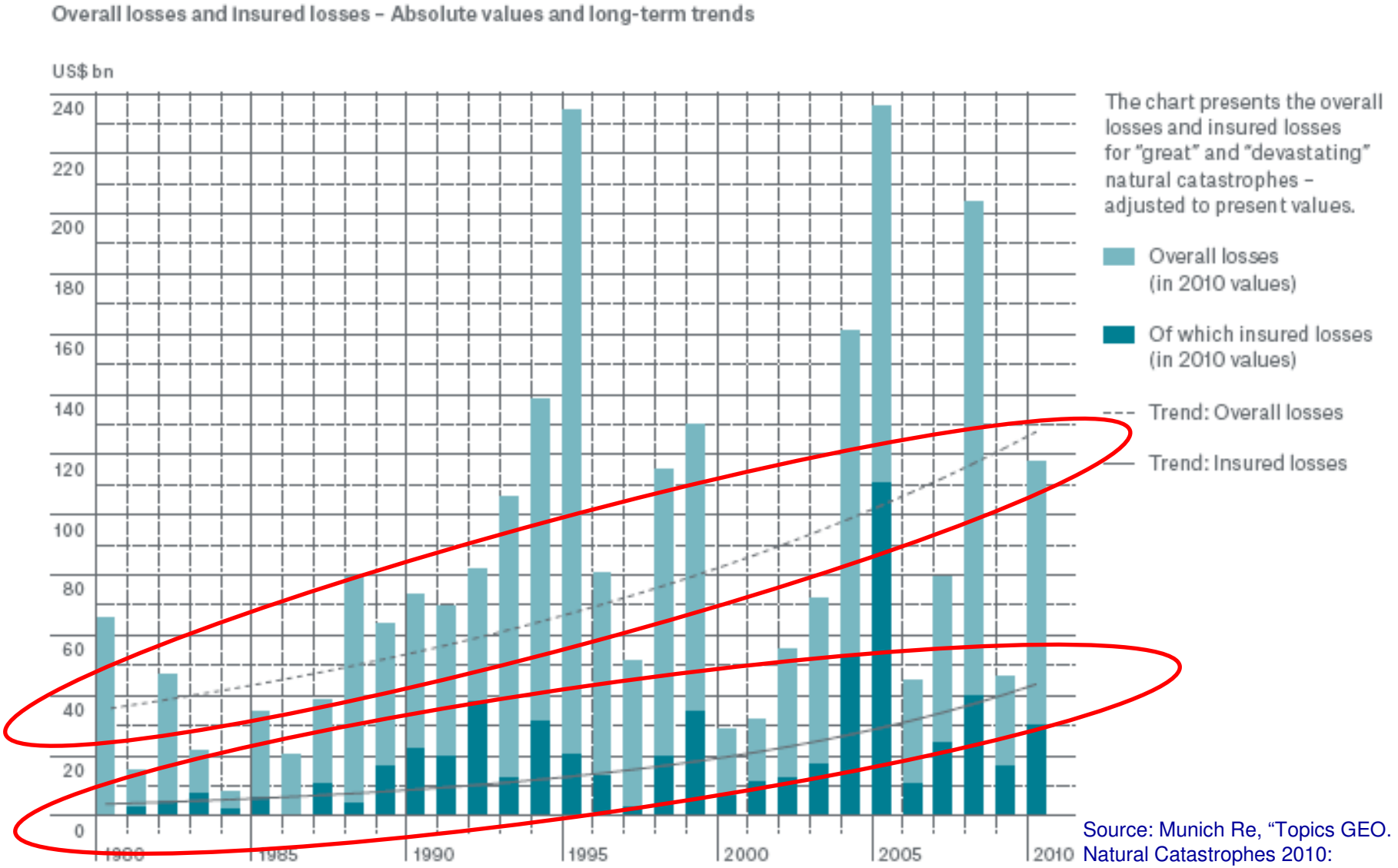
A sign of the times?

Inflow to dams - WA



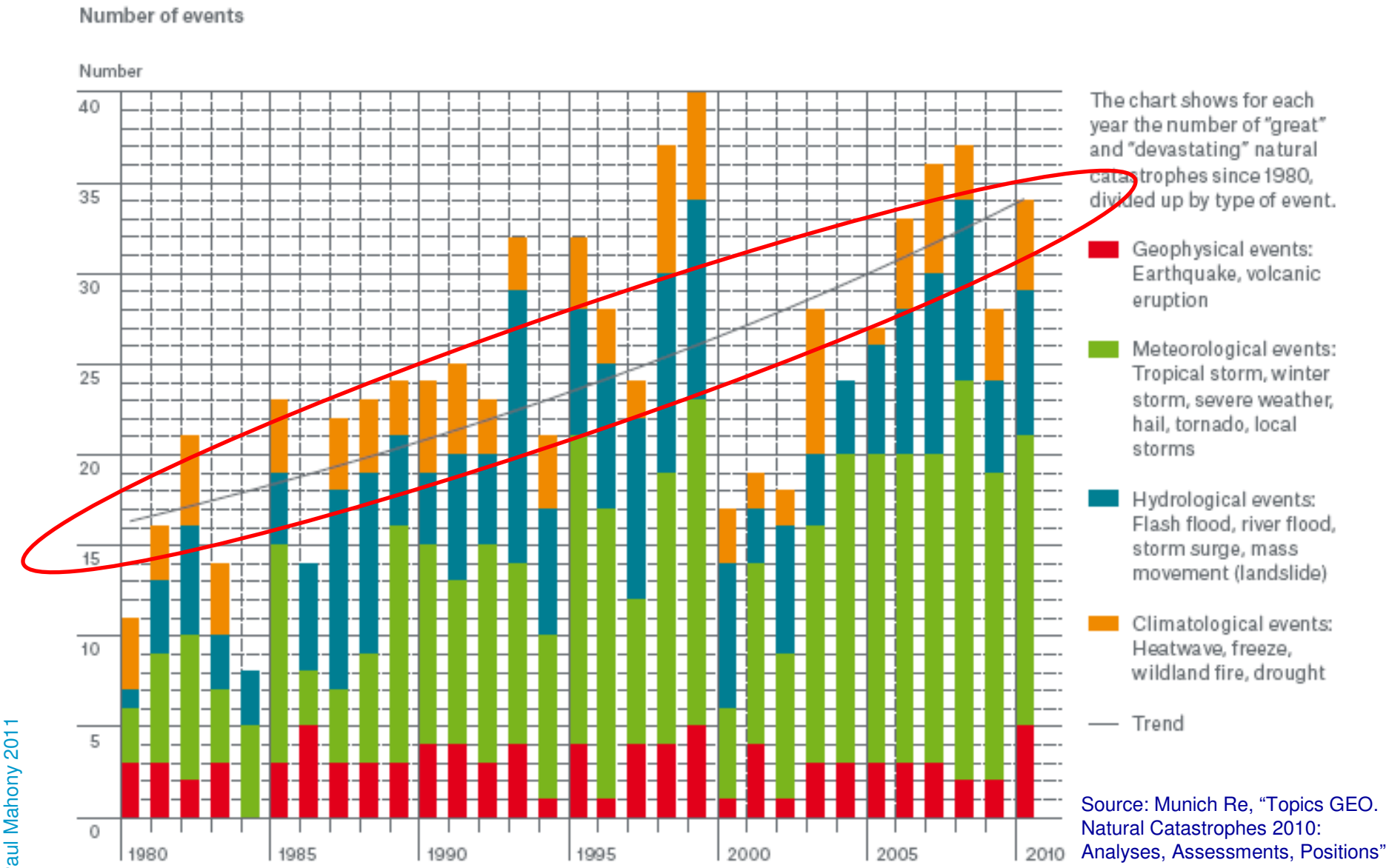
Source: Water Corporation, WA *"Impact on Water Availability – WA Reduced Inflow to Dams"*, http://www.watercorporation.com.au/D/dams_streamflow_large.cfm (Overlays have been inserted by this presenter.)

A sign of the times?



Source: Munich Re, "Topics GEO. Natural Catastrophes 2010: Analyses, Assessments, Positions"

A sign of the times?



Source: Munich Re, "Topics GEO. Natural Catastrophes 2010: Analyses, Assessments, Positions"

A sign of the times?

10 costliest natural disasters ordered by insured losses 1980-2008

Date	Loss event	Region	Overall Losses* (US$m)	Insured losses* (US$m)	Fatalities
25.-30.8.2005	Hurricane Katrina	USA	125,000	61,600	1,322
23.-27.8.1992	Hurricane Andrew	USA	26,500	17,000	62
17.1.1994	Earthquake	USA: Northridge	44,000	15,300	61
6.-14.9.2008	Hurricane Ike	USA: Caribbean	38,000	15,000	168
7.-21.9.2004	Hurricane Ivan	USA: Caribbean	23,000	13,800	125
19.-24.10.2005	Hurricane Wilma	Mexico, USA: Caribbean	20,000	12,400	42
20.-24.9.2005	Hurricane Rita	USA	16,000	12,000	10
11.-14.8.2004	Hurricane Charley	USA: Caribbean	18,000	8,000	36
26.-28.9.1991	Typhoon Mireille	Japan	10,000	7,000	62
26.12.1999	Winter storm Lothar	Europe	11,500	5,900	110

As at January 2009

Source: Munich Re, "Climate Change and Impacts"

What about risk management?

Likelihood: ***The planet is warming rapidly, with at least 90 per cent certainty that this is primarily due to human activities. (IPCC 4th assessment report, 2007)***

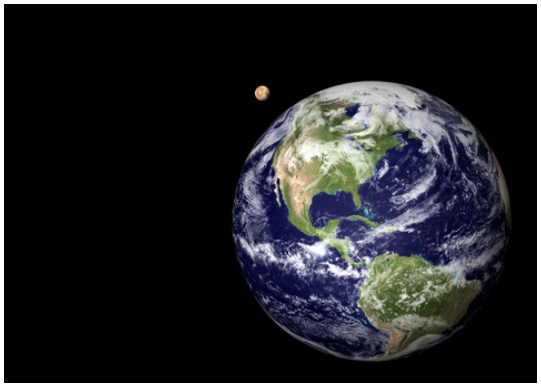
Consequences: ***Catastrophic***

RISK RATING: EXTREME!

WOULD AN ORGANISATION, FACED WITH A RISK OF THIS MAGNITUDE, TAKE MEANINGFUL ACTION OR WOULD IT STALL WHILE BOARD MEMBERS DEBATED?

The need is urgent!

" . . . the world stands . . .



on the edge of a precipice . . .

beyond which human actions will no longer be able to control in any meaningful way the trajectory of the climate system . . ."

David Spratt, co-author of "Climate Code Red: the case for emergency action"

Source: "Global Warming – No more business as usual: This is an emergency!", Environmental Activists' Conference '08: Climate Emergency – No More Business as Usual, 10 October, 2008, reproduced in Links International Journal of Socialist Renewal, http://links.org.au/node/683

The need is urgent!

- ***British glaciologists have recorded water pouring down one of hundreds (possibly thousands) of moulins (craters) on Greenland's 2km thick ice cap at an estimated rate of 42 million litres per day.***

- ***James Hansen of NASA says Greenland's ice cap is now losing more than 250 cubic km of ice per year.***

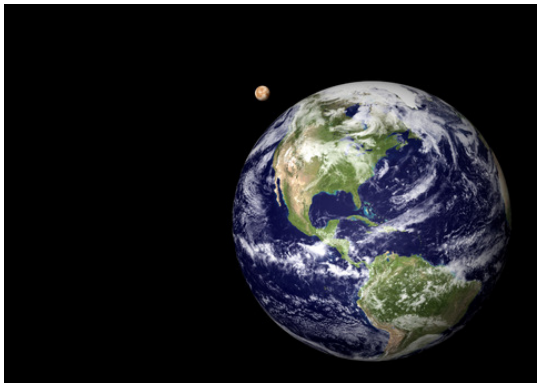
- ***As recently as the 1990's the ice cap was neither losing nor gaining mass at a substantial rate.***

Sources: The Telegraph, 20th Feb 2009, http://www.telegraph.co.uk/earth/environment/climatechange/4734859/Scientists-capture-dramatic-footage-of-Arctic-glaciers-melting-in-hours.html

Hansen, J., *"Storms of my grandchildren"*, 2009, Bloomsbury, p. 287. (An alternative figure had been shown on p. 255 but the correct figure has been confirmed as 250 cubic km.)

A sign of the times?

"Natural climate change is inseparably linked to the history of the earth and its development.



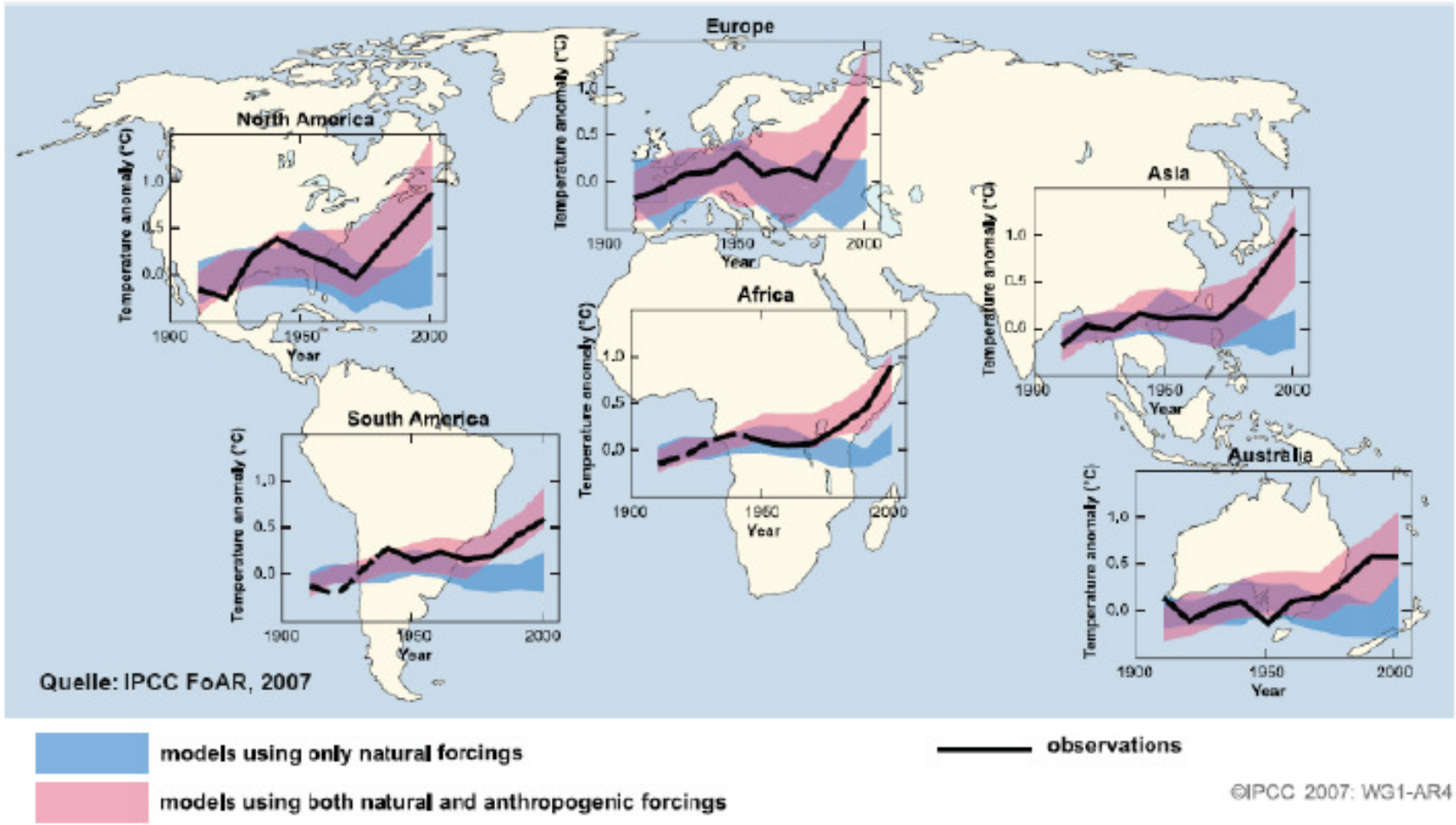
***Human activity** has had a massive impact on the climate system over the past one hundred years - a unique experiment with an indefinite outcome."*

Munich Re, 2005

Source: Munich Re, "Weather catastrophes and climate change: is there still hope for us?", 2005

A sign of the times?

Global warming is real!
Continental temperature changes



Source: IPCC 2007: WG1-AR4, cited in Munich Re, “Climate Change and Impacts”

"A global shift towards a vegan diet is vital to save the world from hunger, fuel poverty and the worst impacts of climate change, a UN report said today."

The Guardian, 2nd June 2010

"A substantial reduction of impacts would only be possible with a substantial worldwide diet change, away from animal products."

United Nations Environment Programme, June 2010

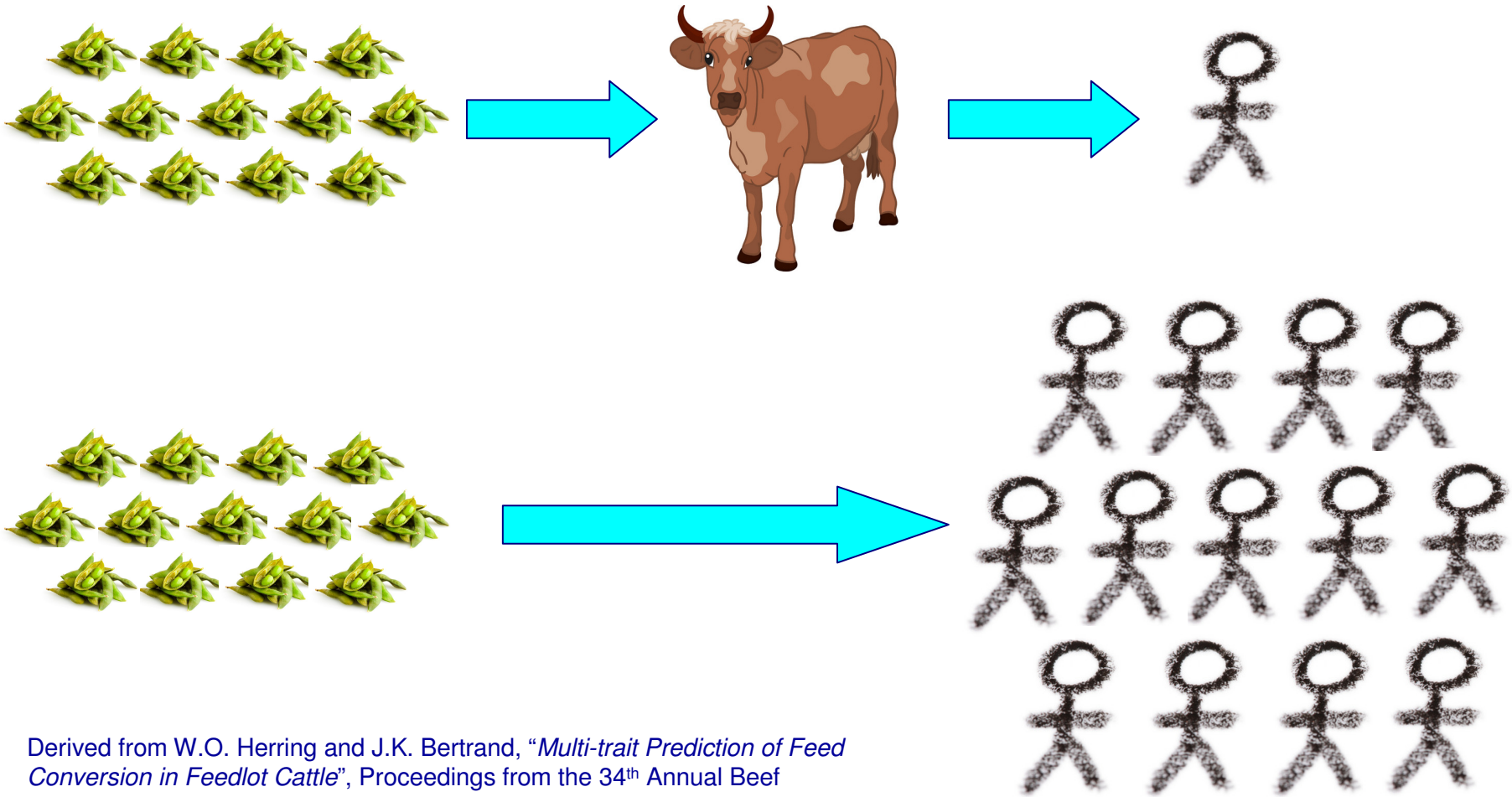
"Livestock are one of the most significant contributors to today's most serious environmental problems. Urgent action is required to remedy the situation."

Henning Steinfeld, United Nations Food & Agriculture Organization, 2006 (Co-author of the UN FAO's "Livestock's Long Shadow" report)

Inefficiency
Scale
GHGs
Deforestation
Water
Nutrition

Livestock

Inherent inefficiencies



Derived from W.O. Herring and J.K. Bertrand, "*Multi-trait Prediction of Feed Conversion in Feedlot Cattle*", Proceedings from the 34th Annual Beef Improvement Federation Annual Meeting, Omaha, NE, July 10-13, 2002, www.bifconference.com/bif2002/BIFsymposium_pdfs/Herring_02BIF.pdf, cited in Singer, P & Mason, J, "*The Ethics of What We Eat*" (2006), Text Publishing Company, p. 210

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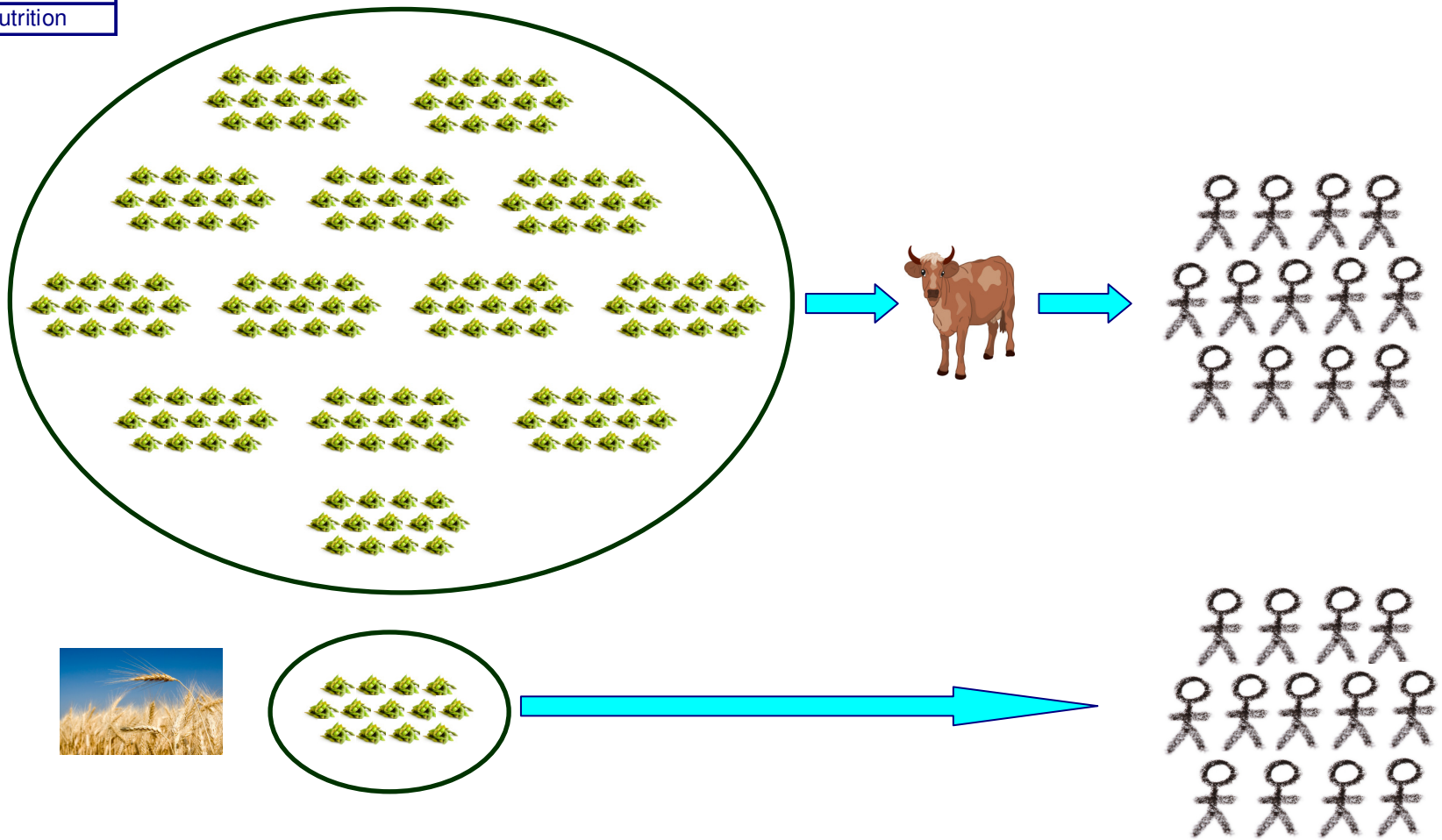

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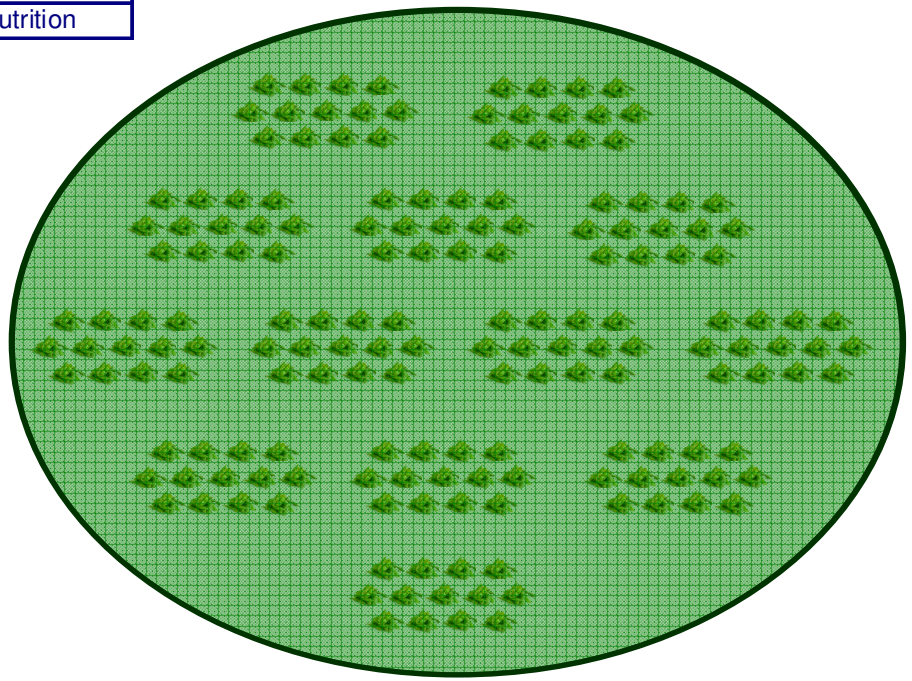

Nutrition via animals involves more:

- **land clearing, with release of CO2 and loss of sequestration;**
- **emissions from farming and transportation;**
- **nitrogen based fertilizer producing nitrous oxide (300 times as potent as CO2);**
- **pesticides, herbicides and antibiotics;**
- **fugitive methane emissions from fertilizer production (using natural gas);**
- **water used and polluted, including oceanic dead zones from nitrogen run-off.**

Derived from W.O. Herring and J.K. Bertrand, "*Multi-trait Prediction of Feed Conversion in Feedlot Cattle*", Proceedings from the 34th Annual Beef Improvement Federation Annual Meeting, Omaha, NE, July 10-13, 2002, www.bifconference.com/bif2002/BIFsymposium_pdfs/Herring_02BIF.pdf, cited in Singer, P & Mason, J, "*The Ethics of What We Eat*" (2006), Text Publishing Company, p. 210

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Inherent inefficiencies

Nutrition via animals involves more:

- **water used and polluted**

The grazing of around 4.5 million cattle in the Great Barrier Reef Catchment has caused widespread soil erosion, resulting in sediments, fertilizers and pesticides entering the Great Barrier Reef World Heritage Area.

Australian Government Great Barrier Reef Marine Park Authority,
http://www.gbrmpa.gov.au/corp_site/key_issues/water_quality/agriculture (accessed 3 July 2008)

Inefficiency
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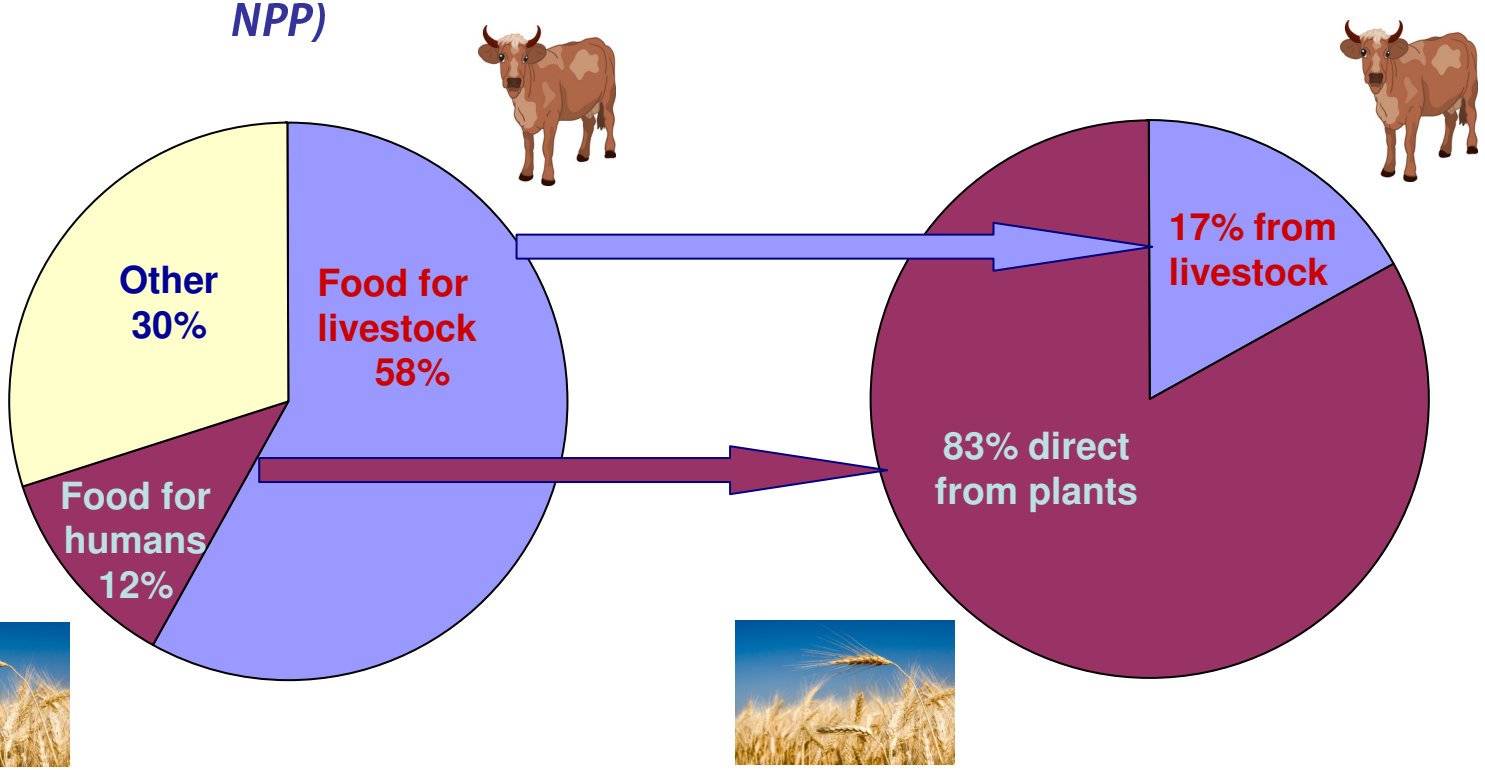
Inherent inefficiencies

Appropriation of Earth's annual plant growth (net primary productivity or NPP)

Humans' calorie (energy) intake



Sources: Derived from Fridolin Krausmann, et al *"Global patterns of socioeconomic biomass flows in the year 2000: A comprehensive assessment of supply, consumption and constraints"* and Helmut Haberl, et al *"Quantifying and mapping the human appropriation of net primary production in earth's terrestrial ecosystems",* cited in Russell, G. "Burning the biosphere, boverty blues (Part 1)", www.bravenewclimate.com

Inefficiency
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Livestock

Inherent inefficiencies

- ***At present, the US livestock population consumes more than 7 times as much grain as is consumed directly by the entire American population.***

  US Department of Agriculture, 2001. Agricultural statistics. Washington, DC

- ***The amount of grains fed to US livestock is sufficient to feed about 840 million people who follow a plant-based diet"***

  Dr David Pimentel, Cornell University *"Livestock production and energy use",* Cleveland CJ, ed. Encyclopedia of energy (in press). [Cited 2003]

The above references were cited in Pimentel, D. & Pimentel M. "Sustainability of meat-based and plant-based diets and the environment", American Journal of Clinical Nutrition, Vol. 78, No. 3, 660S-663S, September 2003

Scale

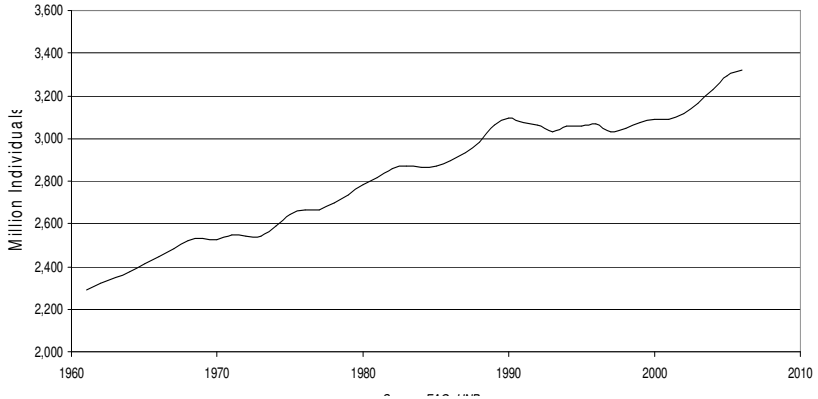
"In the United States, more than 9 billion livestock are maintained to supply the animal protein consumed each year."

US Department of Agriculture, Agricultural statistics, 2001

The above reference was cited in Pimentel, D. & Pimentel M. "Sustainability of meat-based and plant-based diets and the environment", American Journal of Clinical Nutrition, Vol. 78, No. 3, 660S-663S, September 2003

Scale

Cattle, sheep and goat population in 2006 3.3 billion:



Billions slaughtered in 2009:

- Chickens 51.5
- Other 7.8

Total 59.3

- Plus laying hens 6.5
- Plus milk providers 0.7

Livestock biomass is 700 million tonnes compared to human biomass 335 million tonnes.

Livestock/wildlife ratio 23:3

10,000 years ago, all animals were wildlife.

Source: Chart - UN FAO cited in Earth Policy Institute book_wote_ch3_13.xls, http://www.earth-policy.org
Other figures – FAOSTAT, http://faostat.fao.org/site/291/default.aspx,
Biomass – Geoff Russell "Burning the biosphere – Boverty Blues Pt. 1", www.bravenewclimate.com
Livestock/wildlife ratio – UN Food & Agriculture Organization *"Livestock's Long Shadow"*, 2006

Scale

Australia 2008

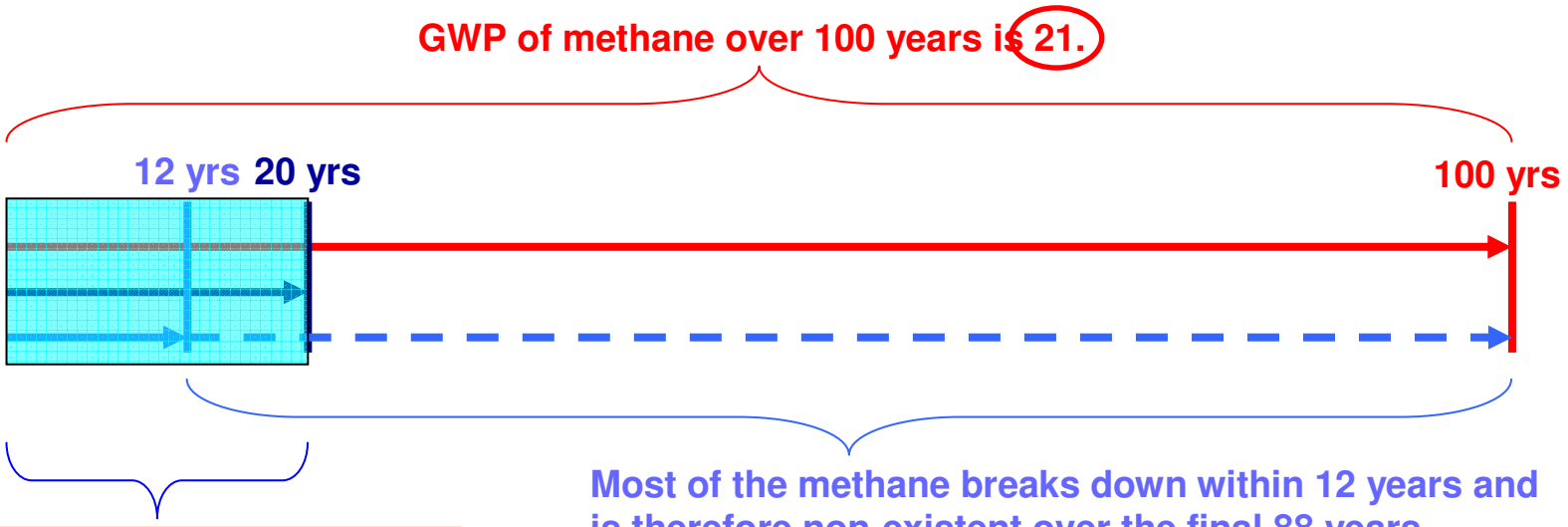
Killed for human consumption:	**Population:**
45 million cows, sheep & pigs	26.3 million cows
475 million chickens	76.9 million sheep
19 million other fowls, turkeys, ducks and drakes	2.4 million pigs

Source: Chart - UN FAO cited in Earth Policy Institute book_wote_ch3_13.xls, http://www.earth-policy.org
Other figures – ABS 1301.0 Year Book Australia 2009-10

CO2-e emissions from livestock

20-year "Global Warming Potential" (GWP)

Most CO2-e measures of methane are based on a period of 100 years.



GWP of methane over 20 years is 72.

This more accurately reflects its shorter-term impact.

Short-term impacts become long-term if they contribute to us reaching tipping points.

Some context for beef: Aluminium

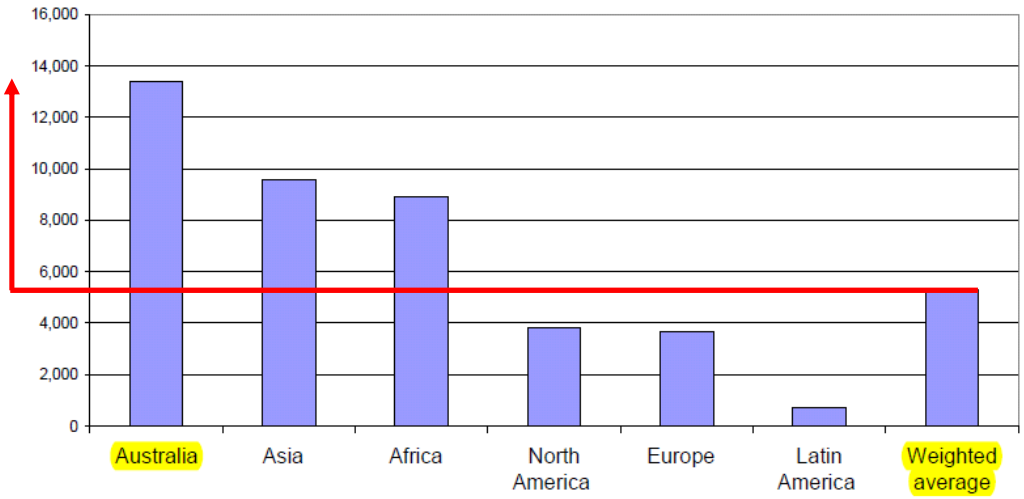
Based on conservative 100 year GWP

Paul Mahony 2011

Some context for beef: Aluminium

Based on conservative 100 year GWP

- **16% of Australia's electricity but provides only 0.06% of jobs and 0.23% of GDP.**
- **2.5 times the world average of GHGs per tonne of product.**



Sources: Hamilton, C, "Scorcher: The Dirty Politics of Climate Change", (2007) Black Inc Agenda, p. 40; Turton, H. "The Aluminium Smelting Industry Structure, market power, subsidies and greenhouse gas emissions", The Australia Institute, Discussion Paper Number 44, January 2002, ISSN 1322-5421, p. ix; Turton, H. "Greenhouse gas emissions in industrialised countries Where does Australia stand?", The Australia Institute, Discussion Paper Number 66, June 2004, ISSN 1322-5421, p. viii.

Some context for beef: Aluminium

Based on conservative 100 year GWP

"To phrase it in terms of the industry joke,* aluminium is congealed electricity*."

Mining Weekly.com

Source: Campbell, K., "Energy crunch constraining aluminium expansions", 27 February, 2006, www.miningweekly.com, http://www.miningweekly.com/article/energy-crunch-constraining-aluminum-expansions-2006-02-27

Inefficiency
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Some context for beef: Aluminium

Livestock

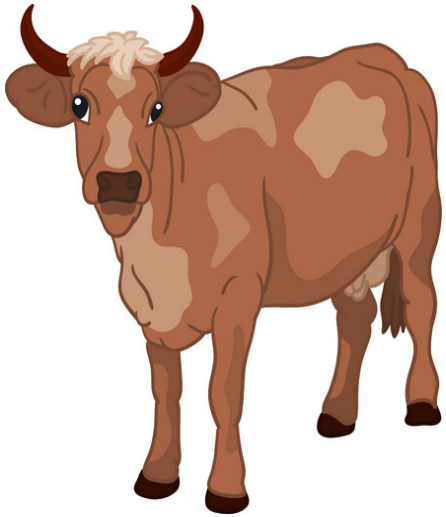
Based on conservative 100 year GWP

"Aluminium is the ultimate proxy for energy"

Marius Kloppers, BHP Billiton CEO

Source: Campbell, K., "Energy crunch constraining aluminium expansions", 27 February, 2006, www.miningweekly.com, http://www.miningweekly.com/article/energy-crunch-constraining-aluminum-expansions-2006-02-27

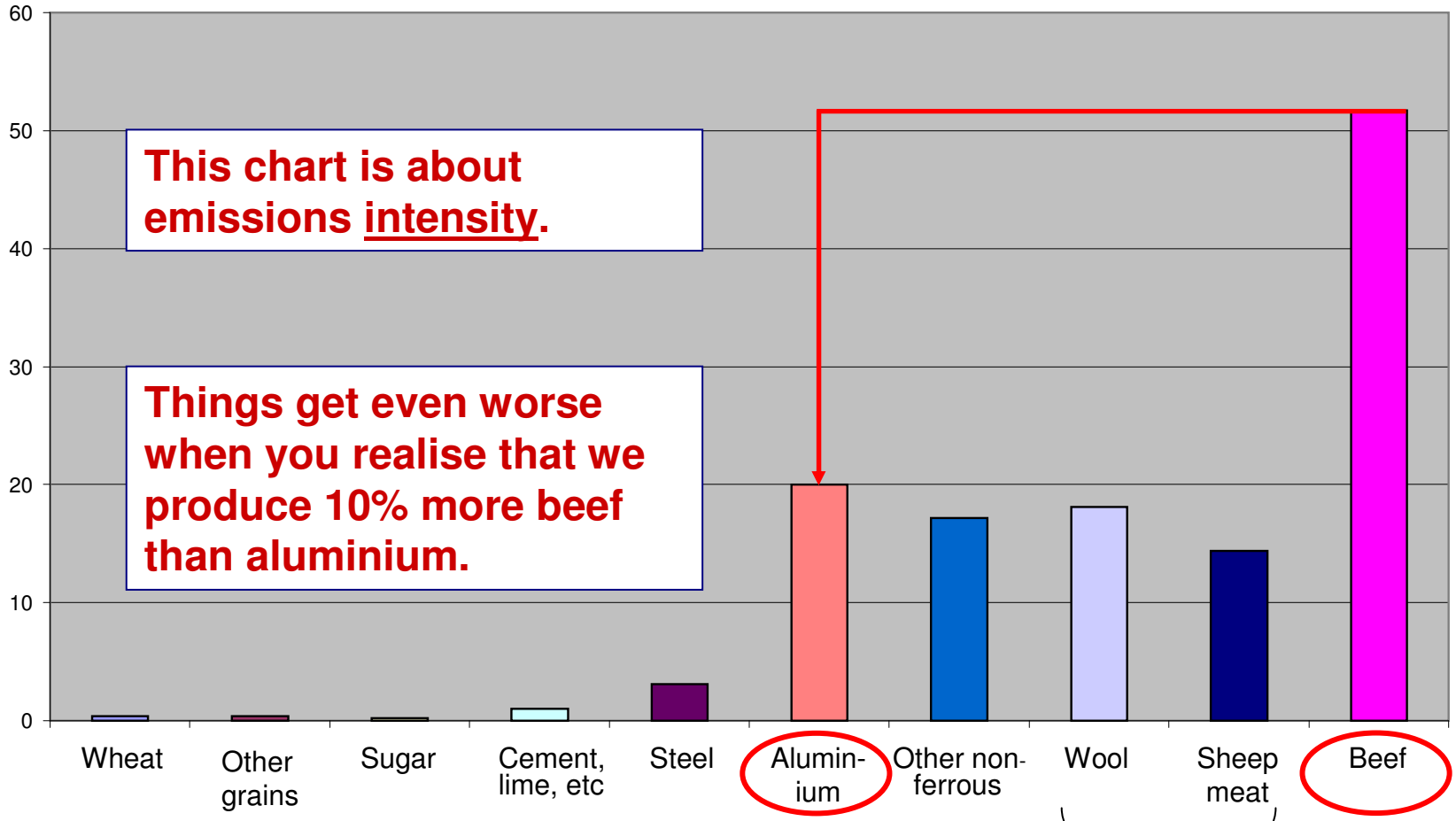
So how does beef compare?

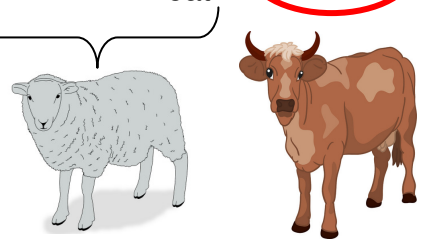


Livestock

Based on conservative 100 year GWP

GHG Emissions Intensity (kg of GHG per kg of product)





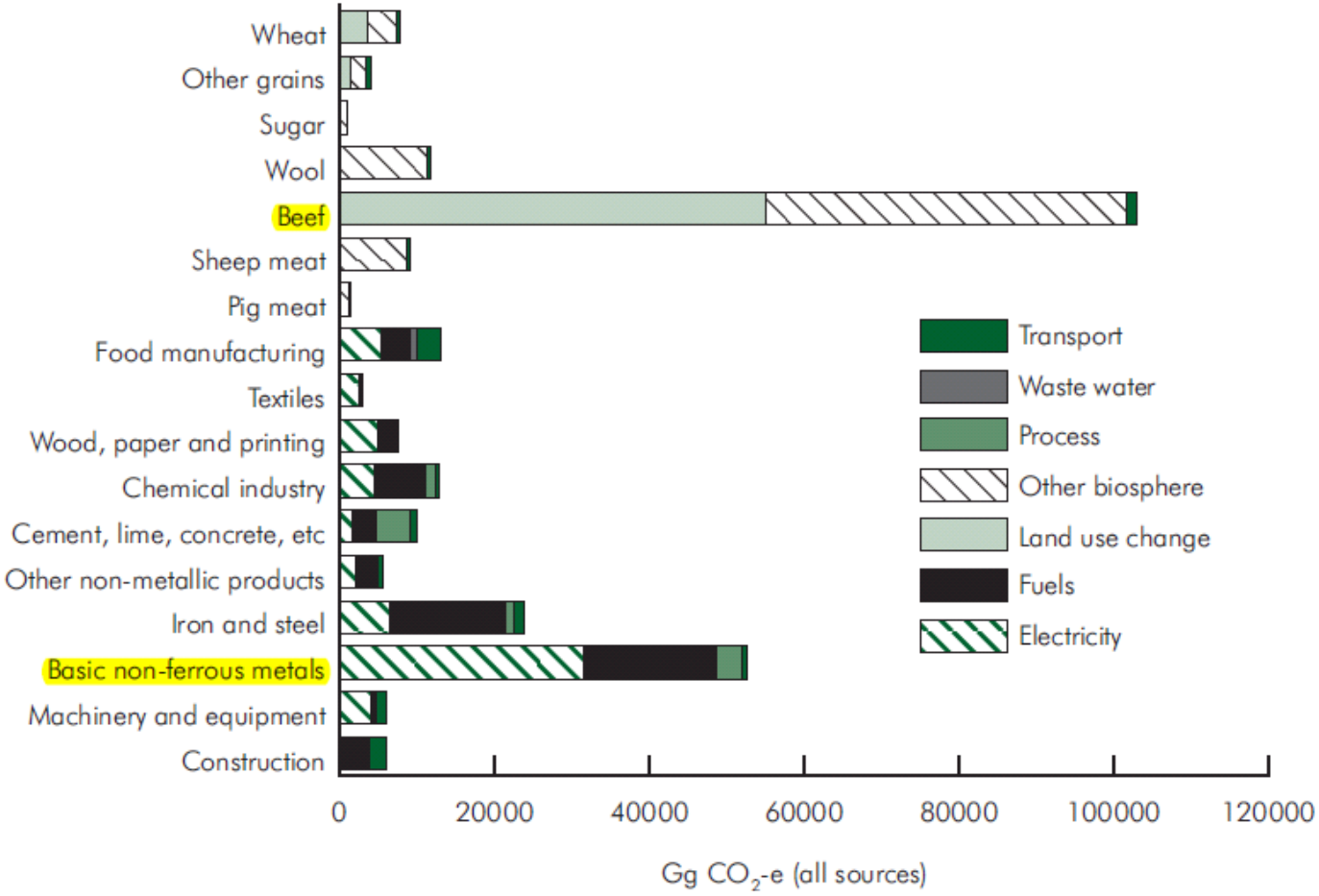
George Wilkenfeld & Associates Pty Ltd and Energy Strategies, National Greenhouse Gas Inventory 1990, 1995, 1999, End Use Allocation of Emissions Report to the Australian Greenhouse Office, 2003, Volume 1, Table S5, p. vii

- Inefficiency
- Scale
- **GHGs**
- Deforestation
- Water
- Nutrition

Livestock

Based on conservative 100 year GWP

GHG Emissions - Absolute



George Wilkenfeld & Associates Pty Ltd and Energy Strategies, National Greenhouse Gas Inventory 1990, 1995, 1999, End Use Allocation of Emissions Report to the Australian Greenhouse Office, 2003, Volume 1, Table S5, p. vii

What about coal-fired electricity?

Inefficiency
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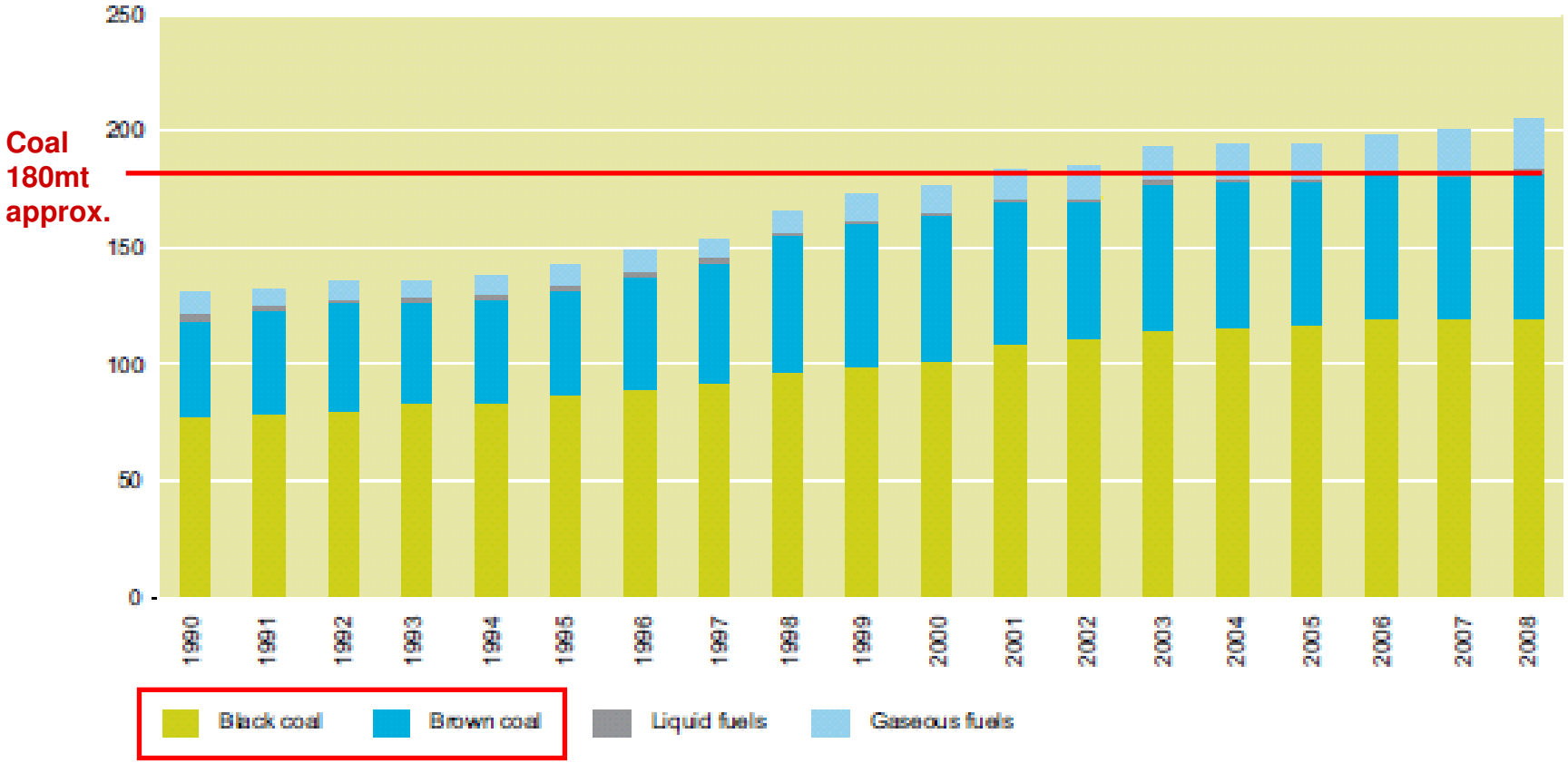
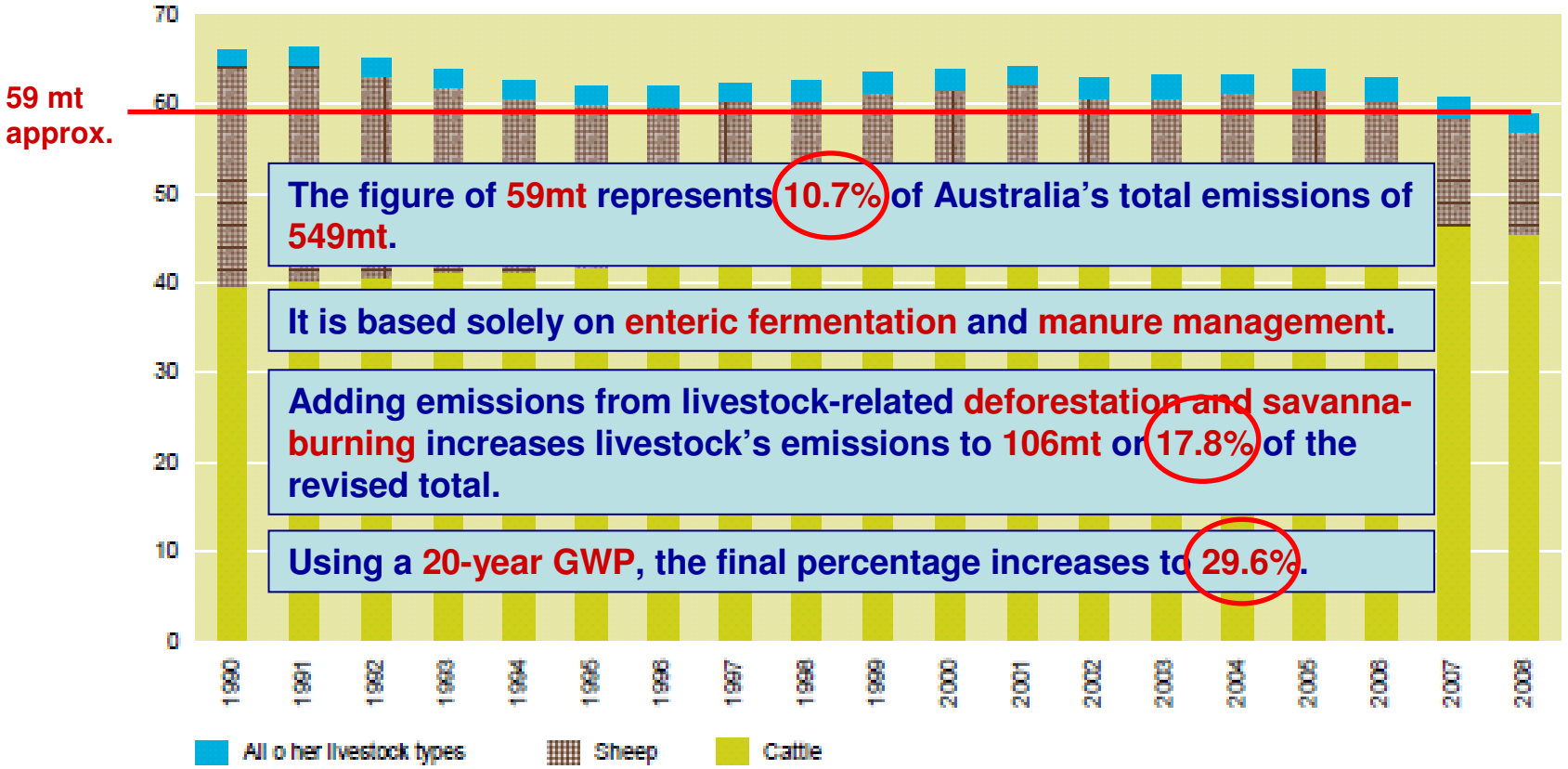
Total CO2-e emissions from electricity generation by fossil fuels



Source: Dept of Climate Change and Energy Efficiency, National Greenhouse Inventory 2008, Fig 7, p. 8.

CO2-e emissions from Australian livestock



The figure of 59mt represents 10.7% of Australia's total emissions of 549mt.

It is based solely on enteric fermentation and manure management.

Adding emissions from livestock-related deforestation and savanna-burning increases livestock's emissions to 106mt or 17.8% of the revised total.

Using a 20-year GWP, the final percentage increases to 29.6%.

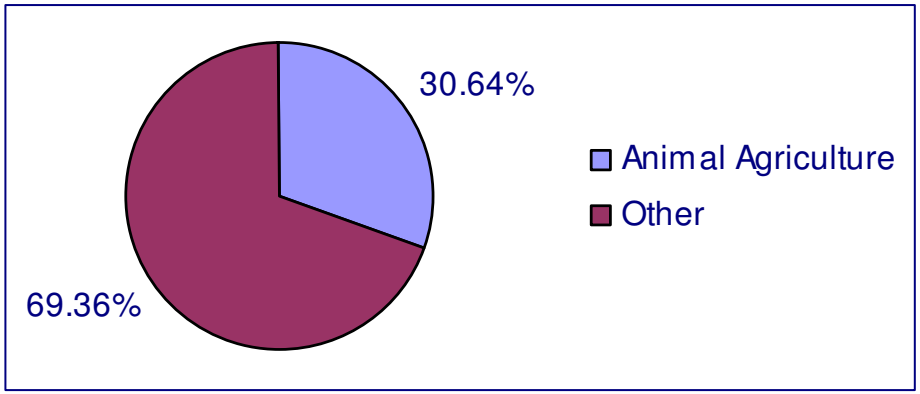
Source:

- Dept of Climate Change & Energy Efficiency, National Greenhouse Inventory 2008, Fig. 15, p. 15
- Livestock's share of deforestation and savanna burning derived from George Wilkenfeld & Associates Pty Ltd and Energy Strategies, National Greenhouse Gas Inventory 1990, 1995, 1999, End Use Allocation of Emissions Report to the Australian Greenhouse Office, 2003

CO2-e emissions from Australian livestock

Based on conservative 100 year GWP

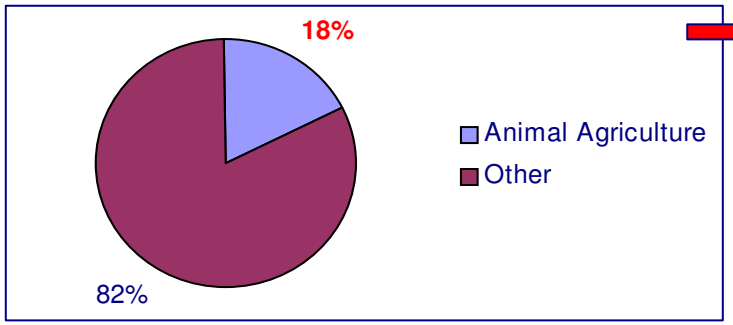
If we were to consider end-use, the percentage would be 30.64%.



Source: The University of Sydney and CSIRO, 2005, "Balancing Act – A Triple Bottom Line Analysis of the Australian Economy"

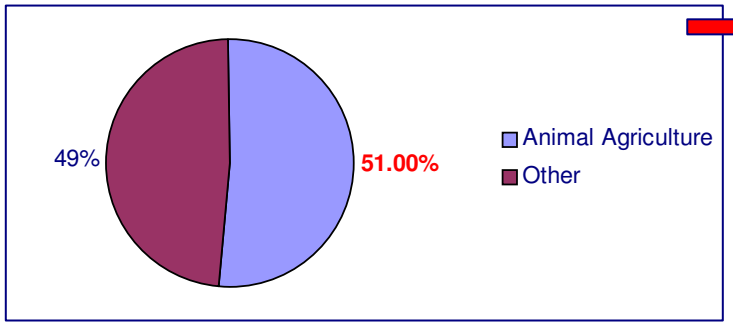
CO2-e emissions from livestock globally

Livestock



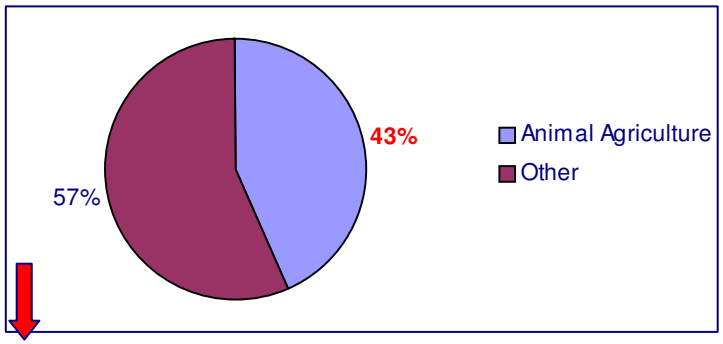
United Nations Food & Agriculture Organization, "Livestock's Long Shadow", 2006

- **Significantly more than all the world's transport**
- **Excludes factors considered by the World Watch Institute (refer below)**



World Watch Institute, 2009

- **20 year GWP on methane**
- **Foregone sequestration on land previously cleared***
- **Livestock respiration overwhelming photosynthesis in absorbing carbon**
- **Increased livestock production since 2002**
- **Corrections in documented under-counting**
- **More up to date emissions figures**
- **Corrections for use of Minnesota for source data**
- **Re-alignment of sectoral information**
- **Fluorocarbons for extended refrigeration**
- **Cooking at higher temperature and for longer periods**
- **Disposal of waste**
- **Production, distribution and disposal of by-products and packaging**
- **Carbon-intensive medical treatment of livestock-related illness**



World Watch Institute, 2009 (amended)

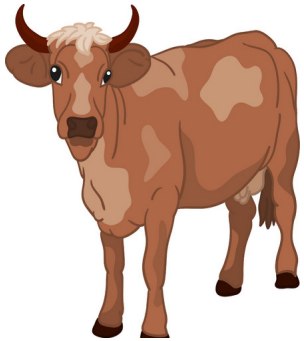
- **As above but amended (by this presenter) by removing livestock respiration as a factor**

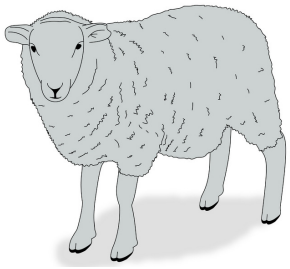
Foregone sequestration still not fully accounted for.

Source of World Watch material: Goodland, R & Anhang, J, *"Livestock and Climate Change - What if the key actors in climate change are cows, pigs, and chickens?"*, World Watch, Nov/Dec, 2009, pp 10-19. (Note: Robert Goodland was formerly lead environmental adviser at the World Bank. Jeff Anhang is a research officer and environmental specialist at the World Bank Group's International Finance Corporation.)

Comparison with electricity generation in Australia
allowing for livestock-related deforestation and savanna burning

Based on conservative 100 year GWP

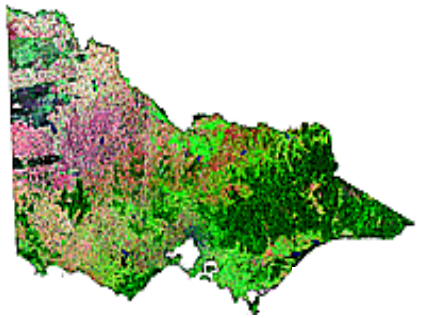




GHG emissions from Australia's LIVESTOCK are equivalent to:

53% of total; and
60% of coal-fired

6.8 times
Hazelwood



1.7 times
Victoria

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Comparison with electricity generation in Australia - Notes

Australia's National Greenhouse Inventory for 2008 (released in May, 2010) provided the following information (with additional material where indicated below):

- **Electricity generation in Australia** produced **204.3 megatonnes** of GHGs *(Appendix 2, Table 2)*.
- The **Hazelwood power station** in Victoria produces around **16 megatonnes** annually.[i]
- Australia as a whole produced 549.5 megatonnes *(Section 4.1 "Overview")*.
- Emissions from livestock were around 59 megatonnes *(Section 4.4 "Agriculture" and Table 15)*.
- The National Greenhouse Inventory's emissions figures for livestock were based solely on enteric fermentation and manure management, and did not take into account deforestation *(Section 4.4, p. 15)*.
- Net emissions from deforestation in 2008 were 49.7 megatonnes *(Section 4.6)*.
- Emissions from savanna burning were 13.6 megatonnes *(Appendix 2, Table 4)*. We have allocated 57% of the savanna burning to livestock (pasture), in line with The Australian Greenhouse Office's 2003 "end use" report.[ii]
- The Australian Greenhouse Office's 2003 "end use" report indicated that 85.1% of cleared land in Australia during the most recent reporting period (1999) was used for cattle grazing.[iii]

Applying the clearing figure of 85.1% to the 2008 deforestation emissions produces a figure of around **42 megatonnes**. (We have not allowed for any proportion of the 10.4% of cleared land used for cropping that may be devoted to livestock feed crop.)

Based on these figures, **livestock are responsible for approximately 109 megatonnes of GHG emissions**.

The 2008 State and Territory Greenhouse Gas Inventories show that **electricity generation in Victoria** produced 63.2 megatonnes of GHG emissions.[iv]

The above figures indicate that the annual GHG emissions from livestock in Australia are equivalent to: (a) 53% of the emissions produced from our (mainly coal-fired) electricity generation; (b) 6.8 times the emissions from the nation's most GHG intensive major power station, Hazelwood in Victoria[v]; and (c) 1.7 times the entire emissions from electricity generation in the State of Victoria (population 5.5 million[vi]).

These comparisons are demonstrated on the following page.[1]

The comparisons raise the question as to why environmental groups in Australia generally pay little attention to livestock, but are willing to run major campaigns against coal-fired power generation, including the Hazelwood power station in Victoria.[vii]

The comparisons with Victoria (including Hazelwood) are particularly significant when one considers that brown coal, the world's most GHG intensive fuel source, is used for 92% of the state's electricity generation.[viii]

---

[i] Rood, D., *"Power cut for big polluter Hazelwood"*, The Age, 10 July, 2010

[ii] George Wilkenfeld & Associates Pty Ltd and Energy Strategies, National Greenhouse Gas Inventory 1990, 1995, 1999, End Use Allocation of Emissions Report to the Australian Greenhouse Office, 2003, Volume 1, Table 5.2, p. 83 (accessed 27 June, 2010).

[iii] George Wilkenfeld & Associates Pty Ltd and Energy Strategies (refer above), Table 5.5, p. 85

[iv] Department of Climate Change and Energy Efficiency, *"State and Territory Greenhouse Gas Inventories 2008"*, May 2010, Appendix 2, Table 3, http://www.climatechange.gov.au/en/climate-change/~/media/publications/greenhouse-accts/state-territory-inventory-2008.ashx (accessed 15 November, 2010)

[v] Map of Victoria accessed from Department of Primary Industries Victoria, Australia via ACU online, Australian Catholic University Ballarat Campus (Aquinas), http://www.rupert.id.au/maps/index.php (accessed 15 November, 2010)

[vi] Australian Bureau of Statistics, *"Australian Demographic Statistics, March 2010, ABS 3101.0"*, released 29 September 2010.

[vii] Environment Victoria, *"Fast-tracking Victoria's clean energy future to replace Hazelwood Power Station: A Report by Green Energy Markets for Environment Victoria"*, May 2010, http://www.environmentvictoria.org.au/sites/default/files/Fast-tracking%20Victoria%27s%20clean%20energy%20future%20to%20replace%20Hazelwood.pdf (accessed 15 November, 2010)

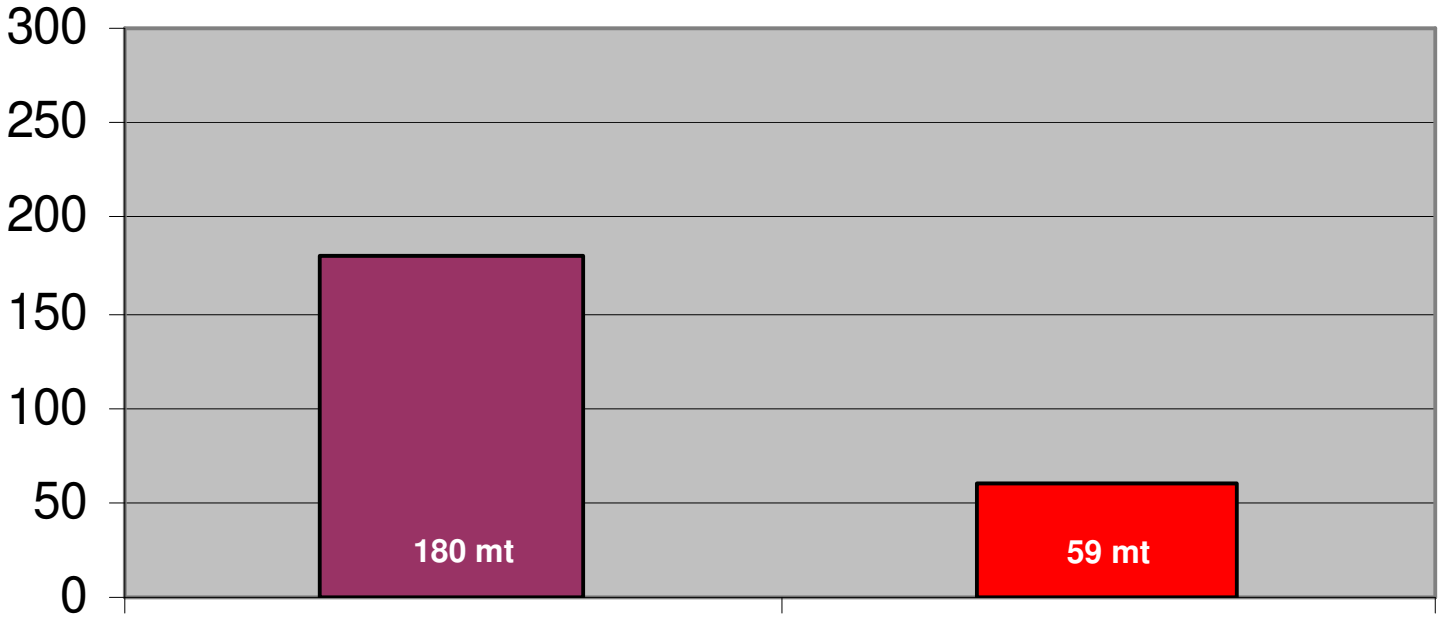
[viii] Brook, Prof. Barry and Russell, Geoff, "Meat's Carbon Hoofprint", Australasian Science, Nov/Dec 2007, pp. 37-39, http://www.control.com.au/bi2007/2810Brook.pdf (accessed 27 June, 2010)

Inefficiency
Scale
GHGs
Deforestation
Water
Nutrition

Livestock

Annual CO2-e emissions from National Greenhouse Inventory 2008

Based on conservative 100 year GWP and excluding deforestation and savanna burning



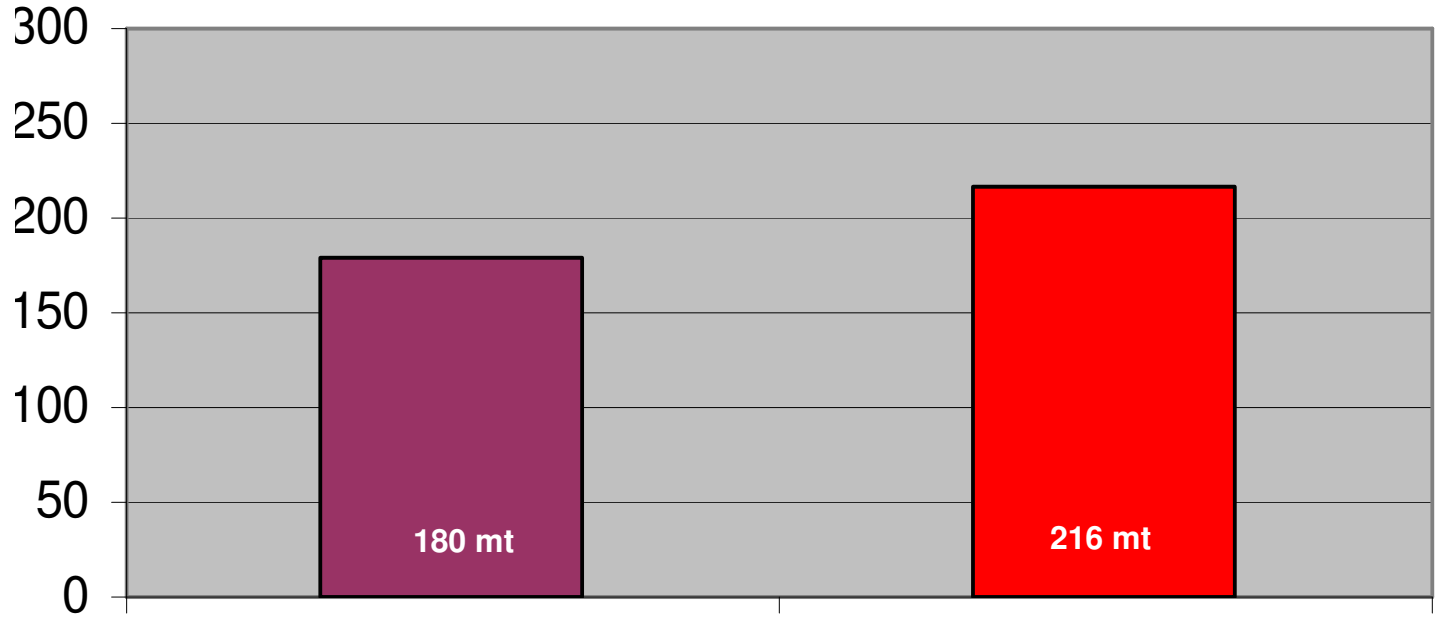
Source: Dept of Climate Change & Energy Efficiency, National Greenhouse Inventory 2008

Inefficiency
Scale
GHGs
Deforestation
Water
Nutrition

Livestock

Annual CO2-e emissions from National Greenhouse Inventory 2008

Amended for 20 year GWP but still excluding deforestation and savanna burning



Coal-fired power **Methane from livestock**

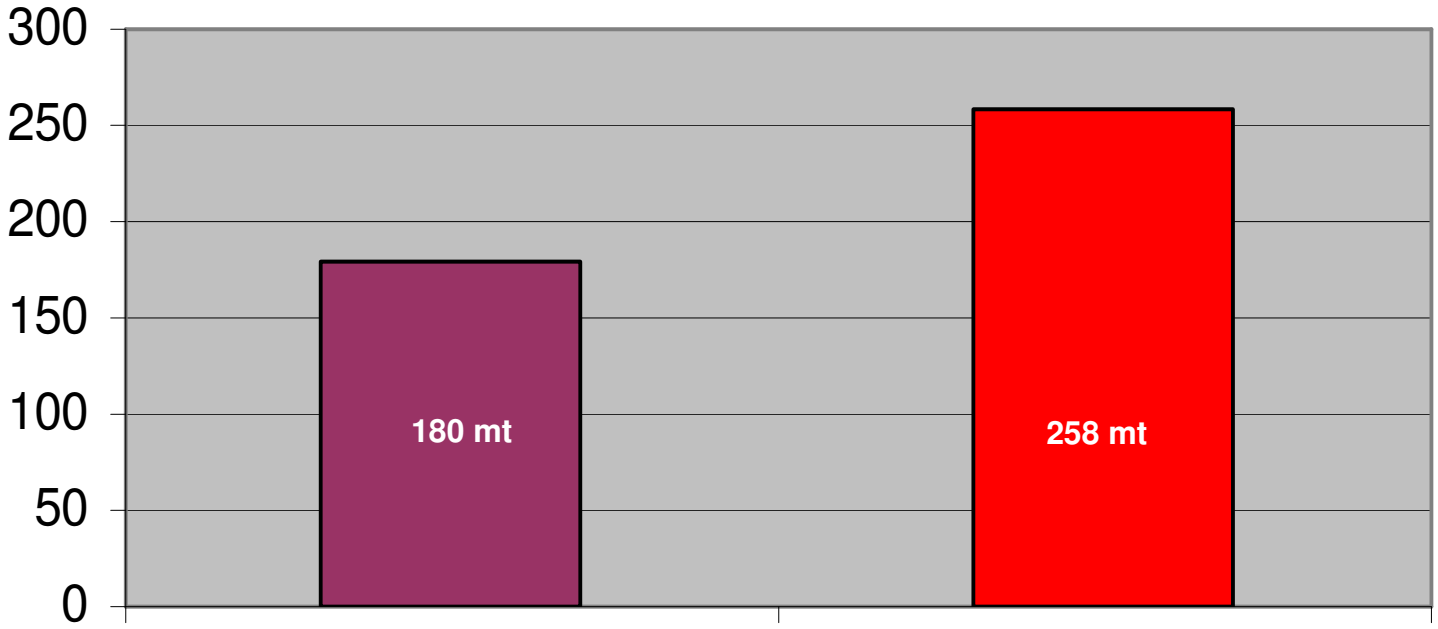
Source: Brook, Prof. Barry and Russell, Geoff, "Meat's Carbon Hoofprint", Australasian Science, Nov/Dec 2007, pp. 37-39, http://www.control.com.au/bi2007/2810Brook.pdf (accessed 27 June, 2010)

Inefficiency
Scale
GHGs
Deforestation
Water
Nutrition

Livestock

Annual CO2-e emissions from National Greenhouse Inventory 2008

Amended for 20 year GWP and now including deforestation and savanna burning

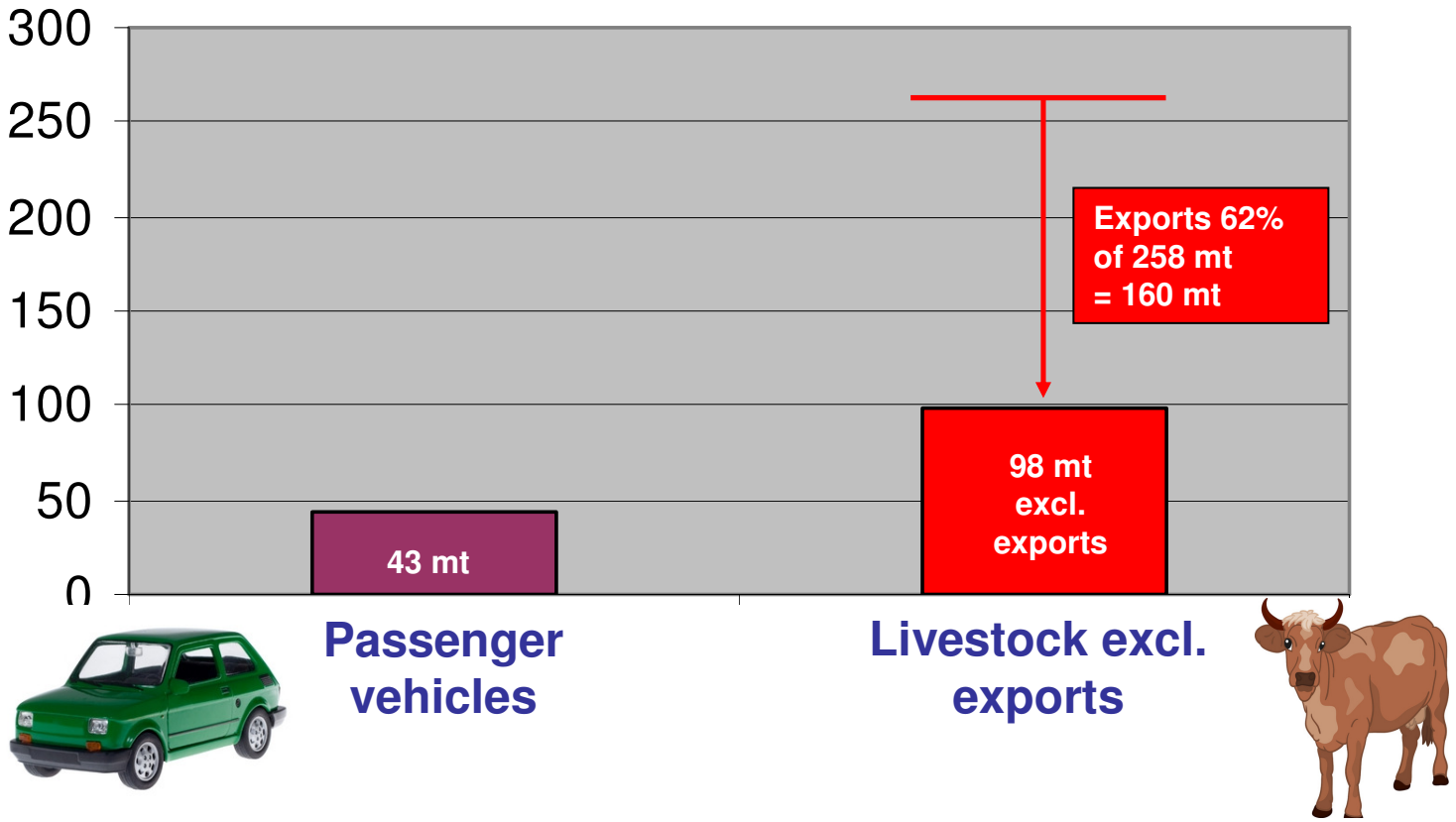


Coal-fired power

Methane, deforestation and savanna burning from livestock

What's better, giving up your car or giving up meat?

Based on 20 year GWP and including deforestation and savanna burning



Source: Vehicle emissions from Brook, Prof. Barry and Russell, Geoff, "Meat's Carbon Hoofprint", Australasian Science, Nov/Dec 2007, pp. 37- 39, http://www.control.com.au/bi2007/2810Brook.pdf (accessed 27 June, 2010)

Livestock production of 98 mt represents an estimate of domestic consumption, using beef as an indicator. 62% of beef is exported. Emissions from all livestock are 258 mt x 38% = 98 mt. Source: http://www.mla.com.au/About-the-red-meat-industry/Industry-overview/Cattle# accessed 3 April, 2011.

Inefficiency
Scale
GHGs
Deforestation
Water
Nutrition

Livestock

Land Clearing

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- Inefficiency
- Scale
- GHGs
- **Deforestation**
- Water
- Nutrition

Livestock

Land Clearing

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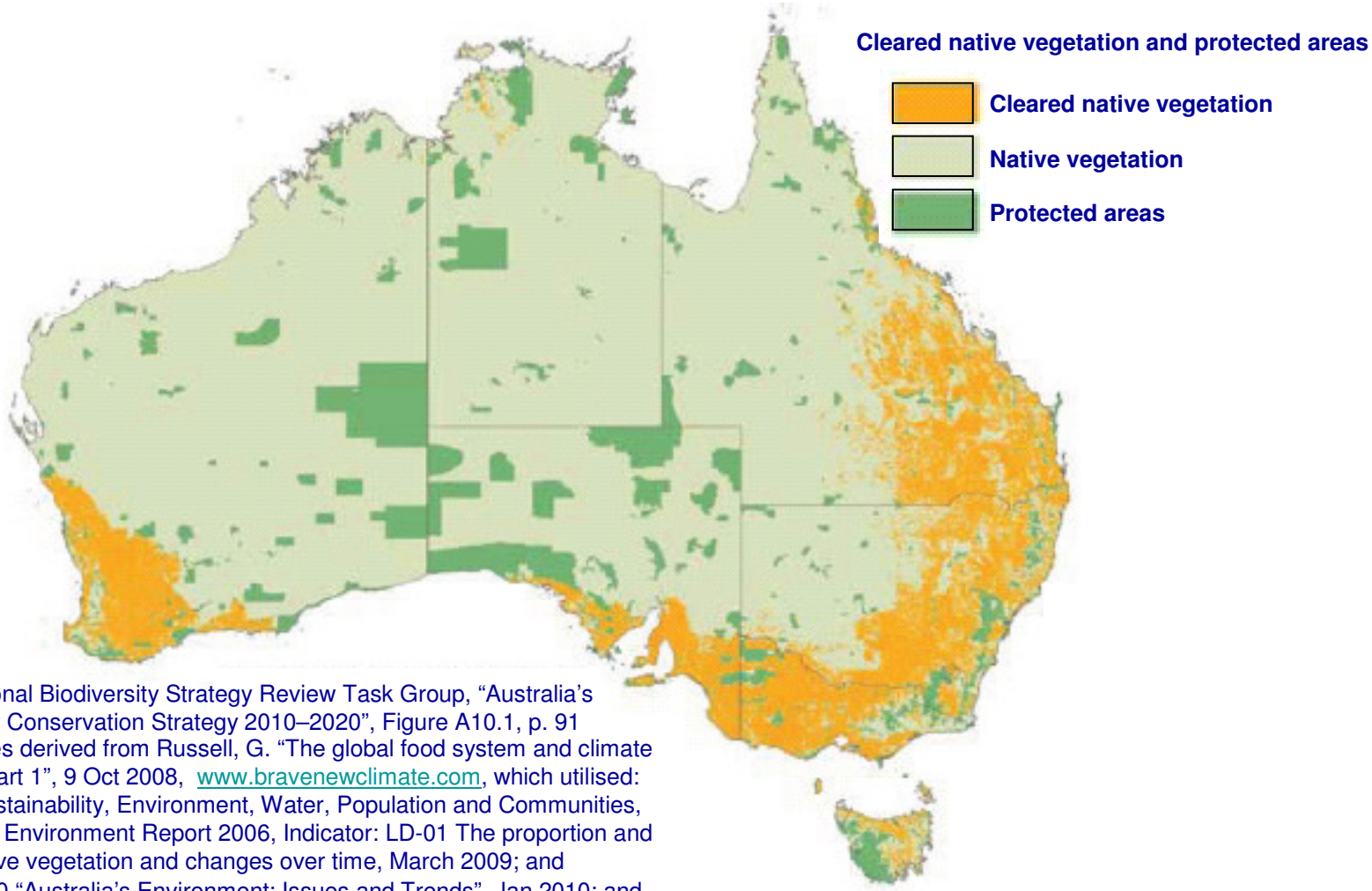
Livestock

Land Clearing in Australia

Total area cleared since European settlement almost 1 million sq. km.

Approx. 70% or almost 700,000 sq km (9% of Australia's land area) is due to livestock.



Sources: Map - National Biodiversity Strategy Review Task Group, "Australia's Biodiversity Conservation Strategy 2010–2020", Figure A10.1, p. 91
Other figures derived from Russell, G. "The global food system and climate change – Part 1", 9 Oct 2008, www.bravenewclimate.com, which utilised:
Dept. of Sustainability, Environment, Water, Population and Communities, State of the Environment Report 2006, Indicator: LD-01 The proportion and area of native vegetation and changes over time, March 2009; and
ABS, 4613.0 "Australia's Environment: Issues and Trends", Jan 2010; and
ABS 1301.0 Australian Year Book 2008, since updated for 2009-10, 16.13 Area of crops

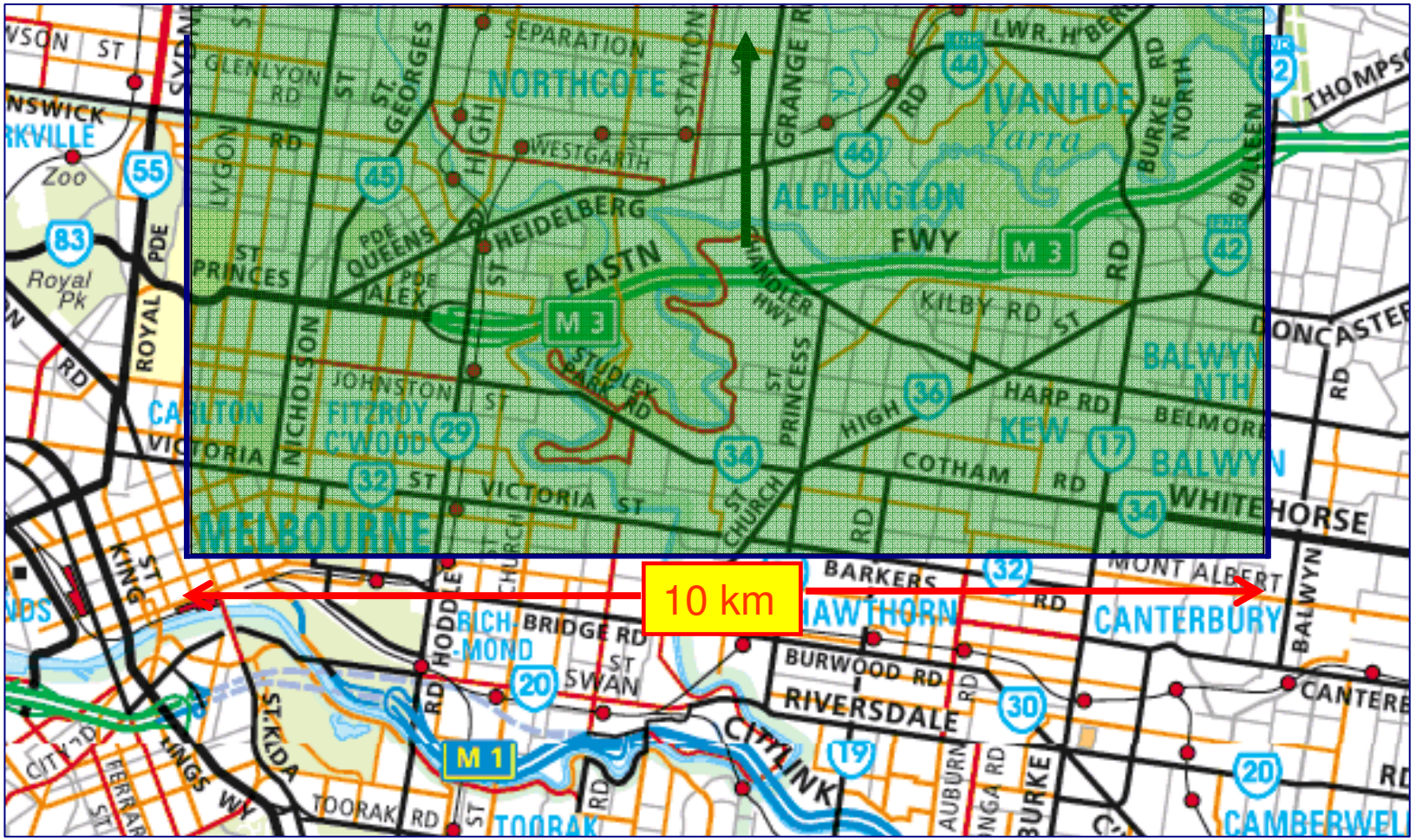
Land clearing in Australia – Queensland 1988 -2008

- **8.6 million hectares (86,000 sq km) cleared in Queensland over 20 years from 1988 to 2008.**
- **91% was for livestock pasture.**
- **If we drew a line 10km east from Melbourne's CBD, it would almost reach Balwyn Rd, Balwyn.**
- **If we assumed that all the land north of that line was forest, how far would we go if we were to clear as much land as was cleared in Queensland for livestock grazing between 1988 and 2008? (See next two slides.)**

Source:
First two points from Bisshop, G. & Pavlidis, L, *"Deforestation and land degradation in Queensland - The culprit"*, Article 5, 16th Biennial Australian Association for Environmental Education Conference, Australian National University, Canberra, 26-30 September 2010

Livestock

Land clearing in Australia – Queensland 1988 -2008



Livestock

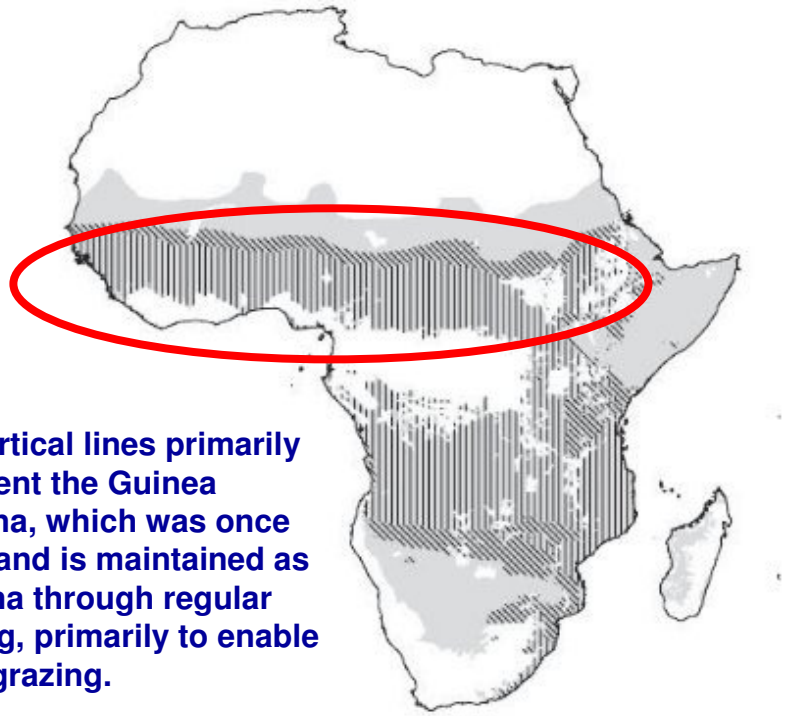
Land clearing in Australia – Queensland 1988 -2008
Approximately 78,000 square kilometres

Source:
Derived from Bisshop, G. & Pavlidis, L, "Deforestation and land degradation in Queensland - The culprit", Article 5, 16th Biennial Australian Association for Environmental Education Conference, Australian National University, Canberra,
26-30 September 2010
Original map: www.street-directory.com.au. Used with permission.
(Cairns inserted by this presenter.)

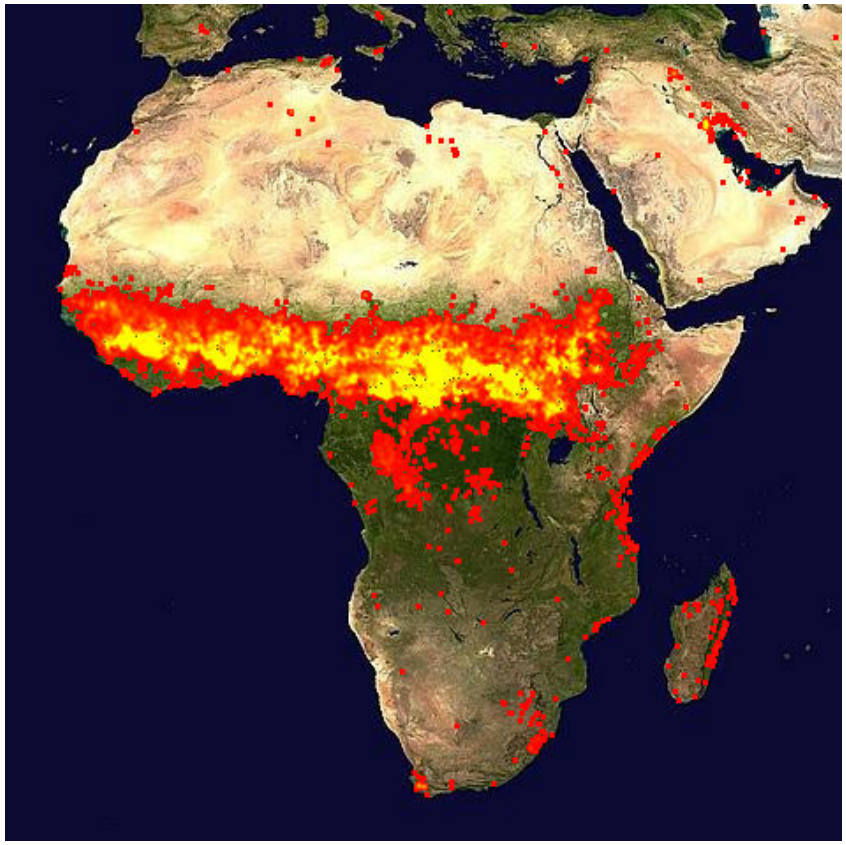
Inefficiency
Scale
GHGs
Deforestation
Water
Nutrition

Livestock

Rainforest destruction in Africa



The vertical lines primarily represent the Guinea Savanna, which was once forest and is maintained as savanna through regular burning, primarily to enable cattle grazing.



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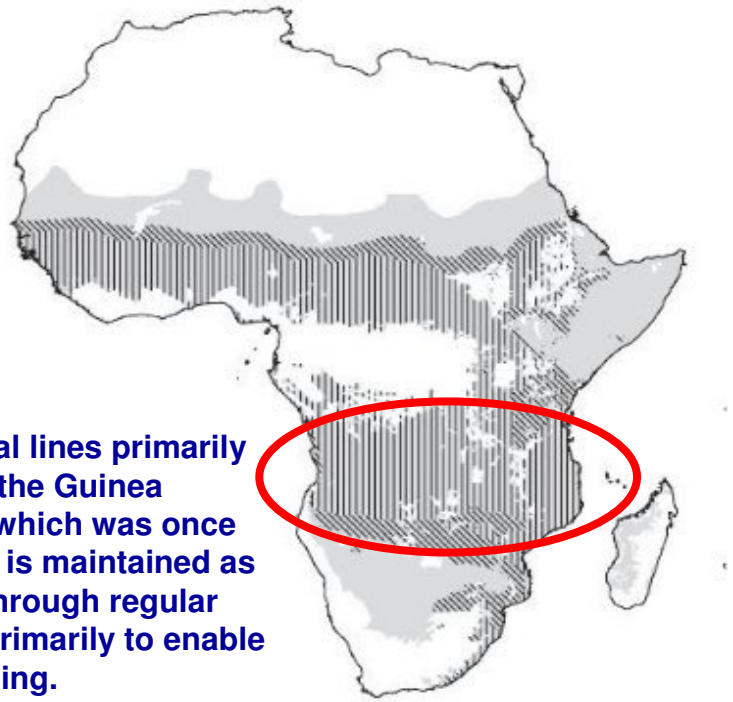
Sources: Sankaran, M; Hanan, N.P.; Scholes, R.J.; Ratnam, J; Augustine, D.J.; Cade, B.S.; Gignoux, J; Higgins, S.I.; Le Roux, X; Ludwig, F; Ardo, J.; Banyikwa, F; Bronn, A; Bucini, G; Caylor, K.K.; Coughenour, M.B.; Diouf, A; Ekaya, W; Feral, C.J.; February, E.C.; Frost, P.G.H.; Hiernaux, P; Hrabar, H; Metzger, K.L.; Prins, H.H.T.; Ringrose, S; Sea, W; Tews, J; Worden, J; & Zambatis, N., "Determinants of woody cover in African savannas", *Nature* 438, 846-849 (8 December 2005), cited in Russell, G. "Burning the biosphere, boverty blues (Part 2)", www.bravenewclimate.com
MODIS Rapid Response Team, NASA Goddard Space Flight Center, http://rapidfire.sci.gsfc.nasa.gov/firemaps/

Inefficiency
Scale
GHGs
Deforestation
Water
Nutrition

Livestock

Rainforest destruction in Africa



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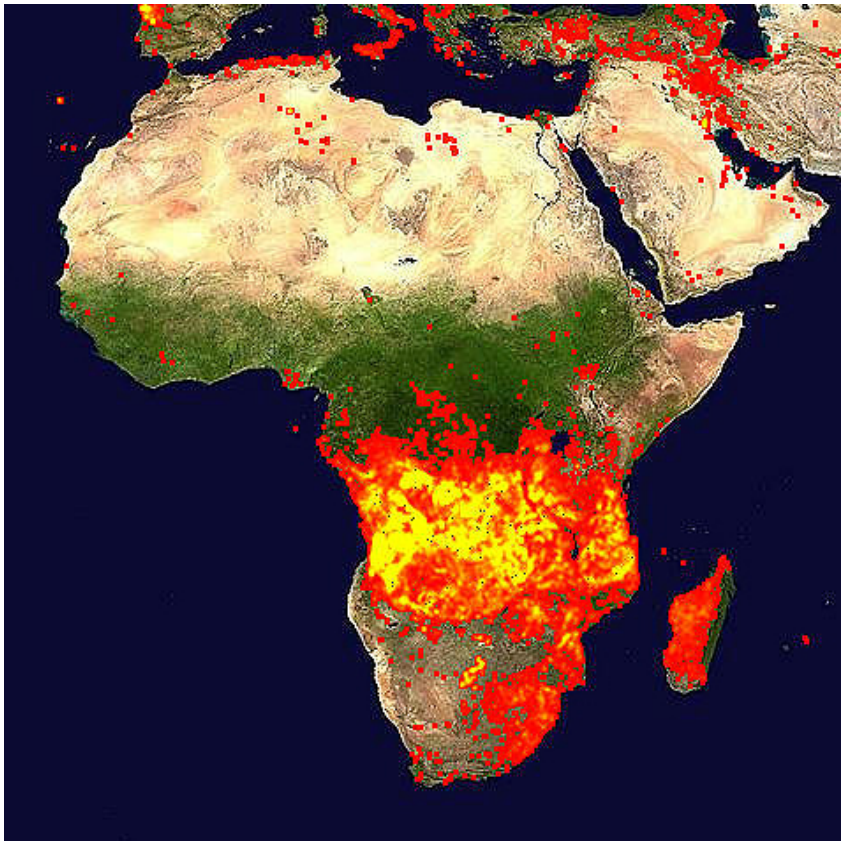
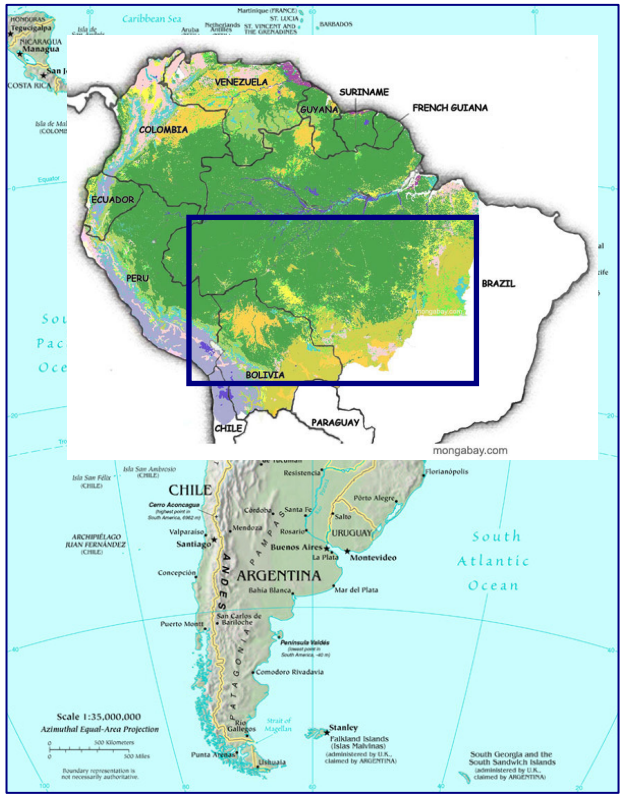
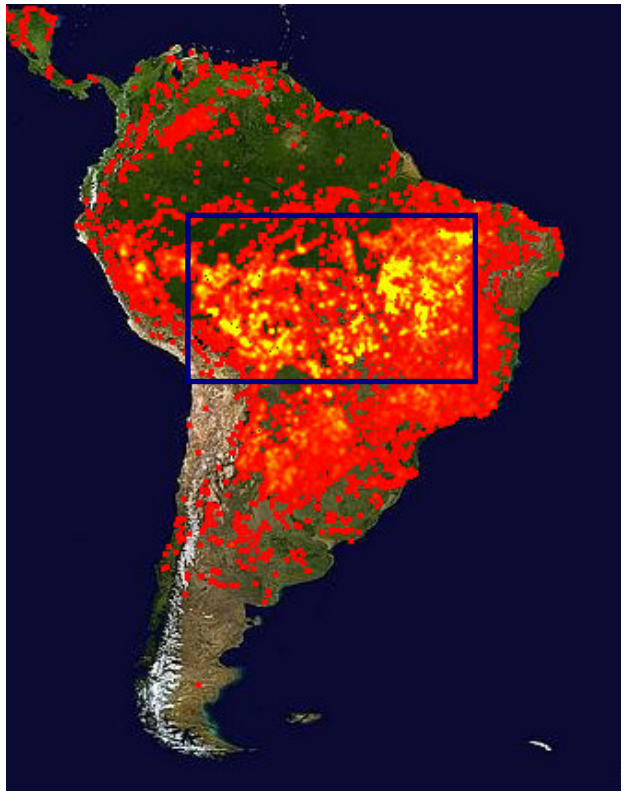


Sources: Sankaran, M; Hanan, N.P.; Scholes, R.J.; Ratnam, J; Augustine, D.J.; Cade, B.S.; Gignoux, J; Higgins, S.I.; Le Roux, X; Ludwig, F; Ardo, J.; Banyikwa, F; Bronn, A; Bucini, G; Caylor, K.K.; Coughenour, M.B.; Diouf, A; Ekaya, W; Feral, C.J.; February, E.C.; Frost, P.G.H.; Hiernaux, P; Hrabar, H; Metzger, K.L.; Prins, H.H.T.; Ringrose, S; Sea, W; Tews, J; Worden, J; & Zambatis, N., "Determinants of woody cover in African savannas", *Nature* 438, 846-849 (8 December 2005), cited in Russell, G. "Burning the biosphere, boverty blues (Part 2)", www.bravenewclimate.com
MODIS Rapid Response Team, NASA Goddard Space Flight Center, http://rapidfire.sci.gsfc.nasa.gov/firemaps/

Rainforest destruction in South America





http://www.world-maps.co.uk/continent-map-of-south-america.htm

http://rainforests.mongabay.com/amazon/amazon_map.html

MODIS Rapid Response Team, NASA Goddard Space Flight Center - http://rapidfire.sci.gsfc.nasa.gov/firemaps/

70 percent of previously forested land in the Amazon is occupied by livestock pastures, and livestock feedcrops cover a large part of the remainder (United Nations Food & Agriculture Organization, *"Livestock's Long Shadow"*, 2006)

Black carbon information: Presentation by Gerard Bisshop, World Preservation Fund presentation to Cancun Climate Summit, Dec, 2010 *"Shorter lived climate forcers: Agriculture Sector and Land Clearing for Livestock"* (co-authors Lefkothea Pavlidis and Dr Hsien Hui Khoo)

Inefficiency
Scale
GHGs
Deforestation
Water
Nutrition

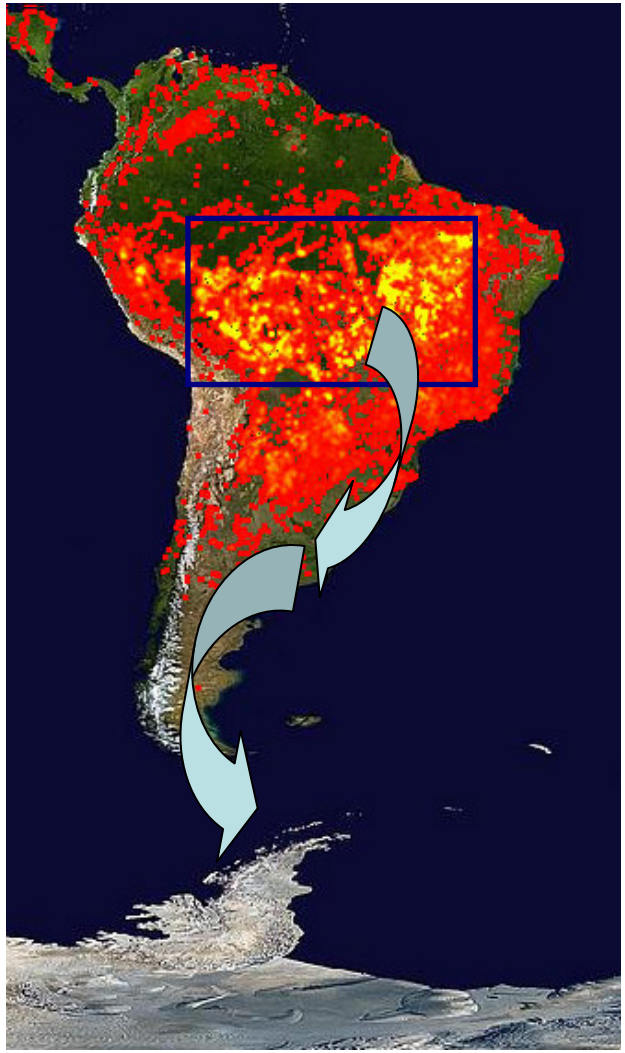
Livestock

Rainforest destruction in South America

Winds transport black carbon from the Amazon to the Antarctic Peninsula.

47% to 61% of black carbon in Antarctica comes from pasture management in the Amazon and Africa.

Black carbon melts ice rapidly by absorbing heat from sunlight.



http://www.world-maps.co.uk/continent-map-of-south-america.htm

http://rainforests.mongabay.com/amazon/amazon_map.html

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James Hansen – Essential Measures

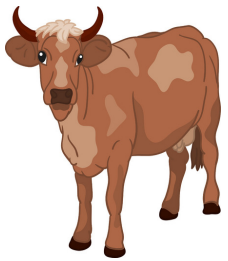
1. *End coal-fired power.*
2. *Massive reforestation.*

Required to reduce CO2 concentrations to < 350 ppm (currently 390 ppm approx.)

3. *Significantly reduce non-CO2 forcings, e.g. methane, nitrous oxide, tropospheric ozone and black carbon.*

A key factor in reducing CO2 concentrations will be measure 2.

Not possible without addressing animal agriculture

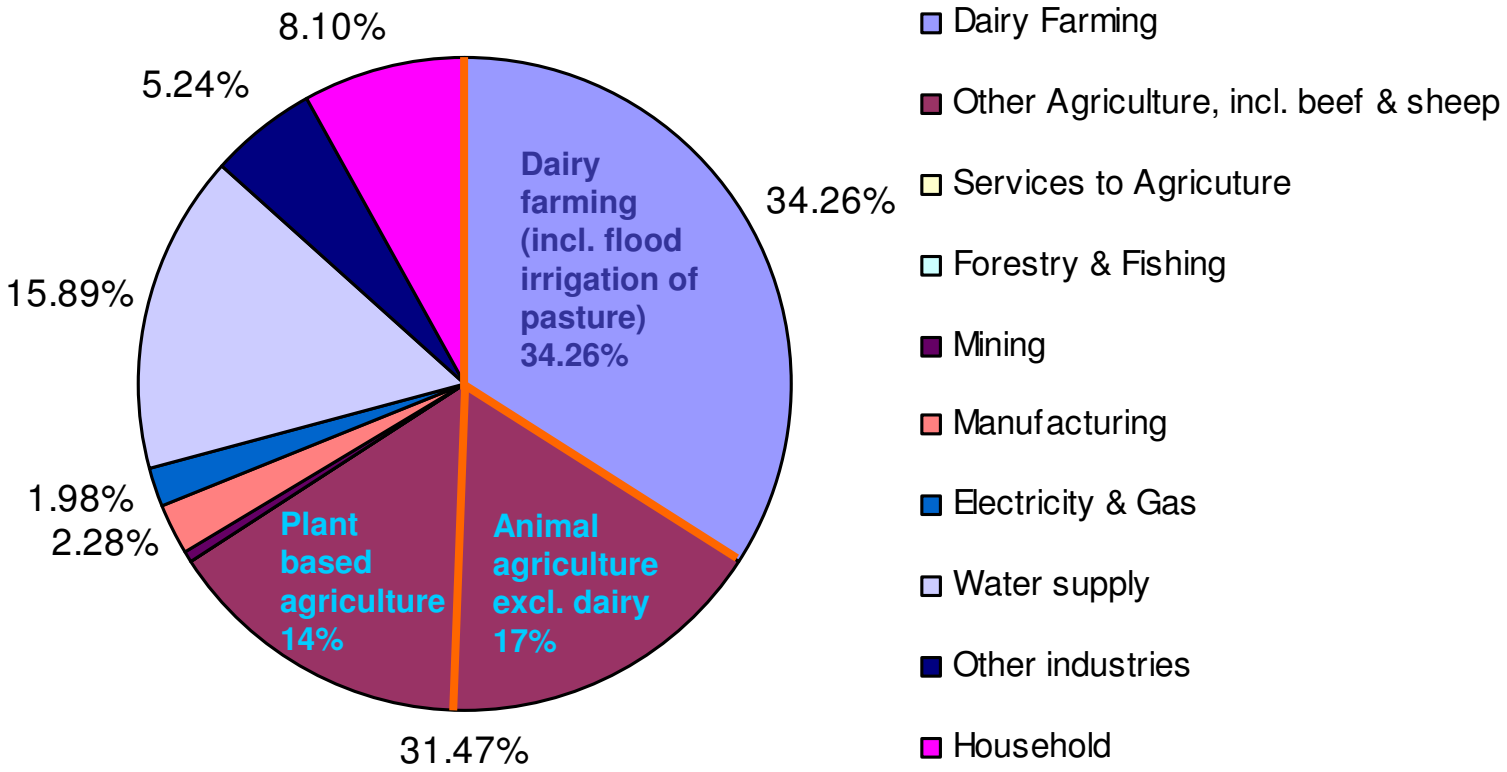


Hansen says a CO2 target of <350ppm won't solve the problem without measure 3.

Not possible without addressing animal agriculture

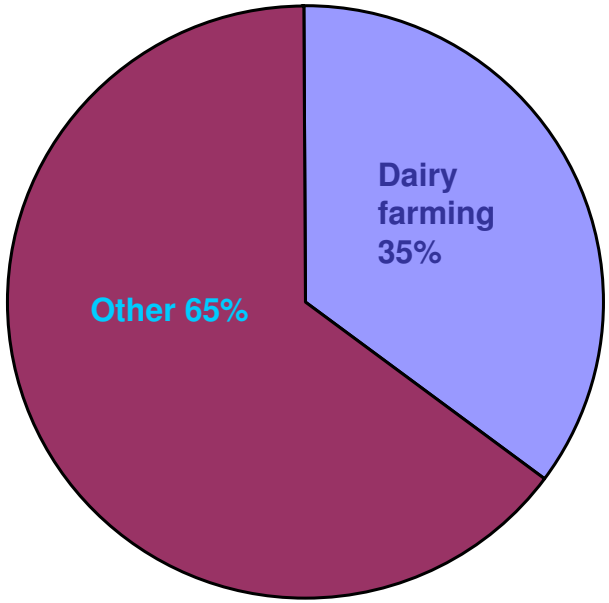
Source: Hansen, J; Sato, M; Kharecha, P; Beerling, D; Berner, R; Masson-Delmotte, V; Pagani, M; Raymo, M; Royer, D.L.; and Zachos, J.C. "Target Atmospheric CO2: Where Should Humanity Aim?", 2008.

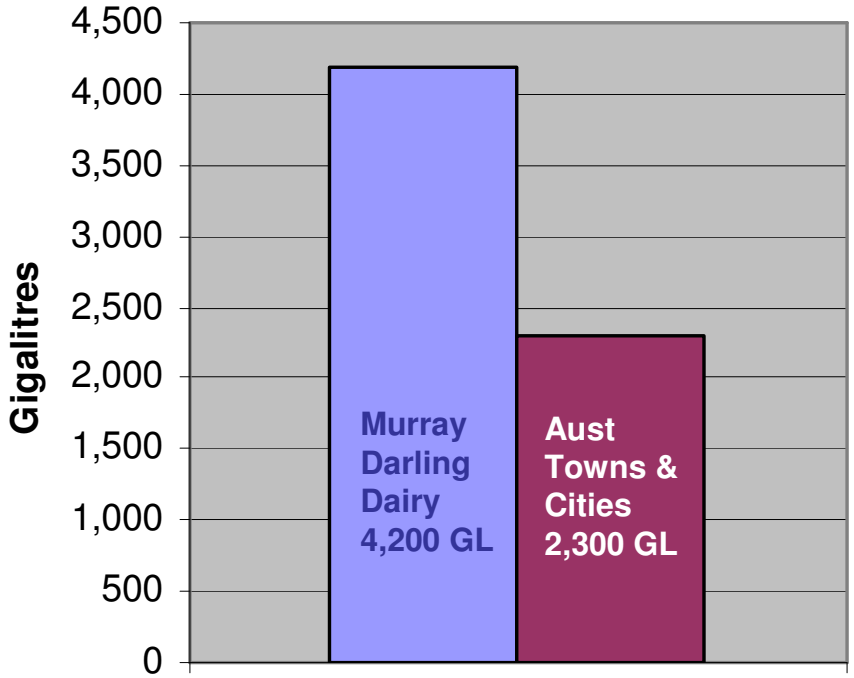
Water Consumption - Victoria



Source: Australian Bureau of Statistics, Water Account, Australia, 2004-05, 4610.0, Media Release 112/2006, November 28, 2006
Australian Bureau of Statistics, Water Use on Australian Farms, 2004-05, 4618.0

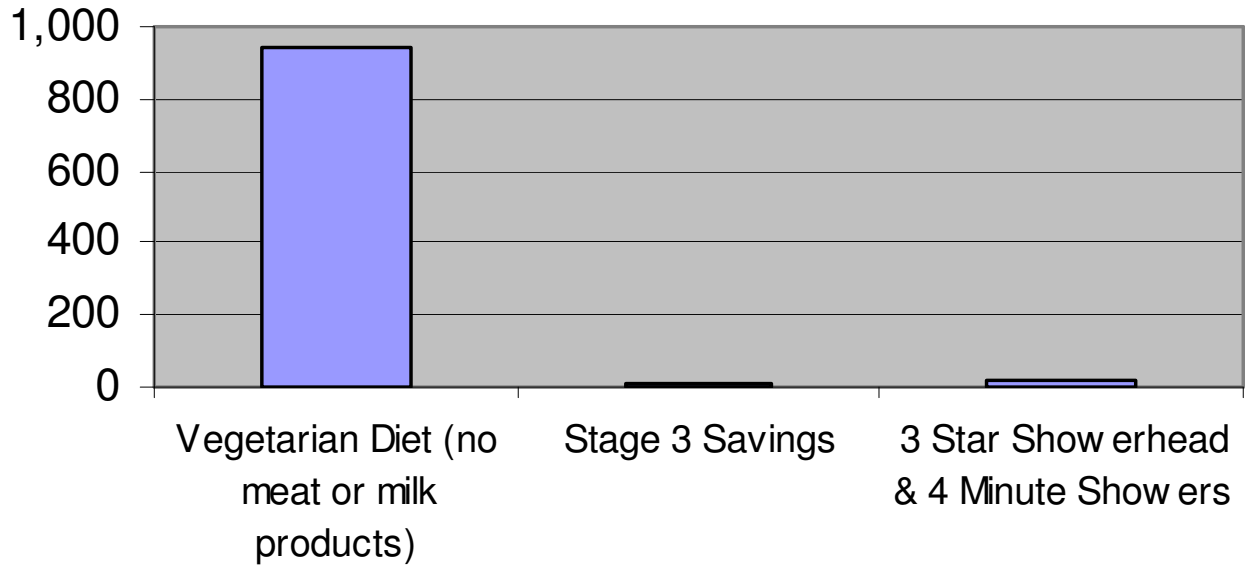
Water Consumption – Murray Darling Basin





Source: Russell, G. *"Water for cattle"*, Letters to the Editor, New Scientist Print Edition, 7 July, 2007, Issue 2611, p. 21, http://www.newscientist.com/article/mg19526111.300-water-for-cattle.html including reference to Bryan, B & Marvanek, S, *"Quantifying and valuing land use change for Integrated Catchment Management evaluation in the Murray-Darling Basin 1996/97-2000/01. Stage 2 Report to the Murray-Darling Basin Commission"* , CSIRO Land and Water, Nov, 2004

Comparative water savings per annum ('000 litres)



1 year on a vegan diet = **45 years of 4 min., 3 star showers**

Source: Derived from Ian Rutherfurd, School of Social and Environmental Enquiry, University of Melbourne, Amelia Tsang and Siao Khee Tan, Department of Civil and Environmental Engineering, University of Melbourne (2007) *"City people eat rivers: estimating the virtual water consumed by people in a large Australian city"*

Inefficiency
Scale
GHGs
Deforestation
Water
Nutrition

Livestock

Nutrition – Meat & Livestock Australia
"Five essential ingredients in one amazing food"

He's handsome, charismatic and intelligent. Unfortunately, we're not so sure about Sam.

Nutrition

Food	Amino Acid (Protein) Score	Completeness Score
Trout	148	48
Beef	144	29
Pork	136	36
Chicken	136	32
Spinach	120	93
Soybeans	118	52
Potato	109	52
Tofu	107	49
Quinoa	106	45
Cauliflower	102	74
Lentils	86	58
Broccoli	83	92
Rice	71	27
Walnuts	55	26
Almonds	54	42

Legend:

Animal-based

Plant-based

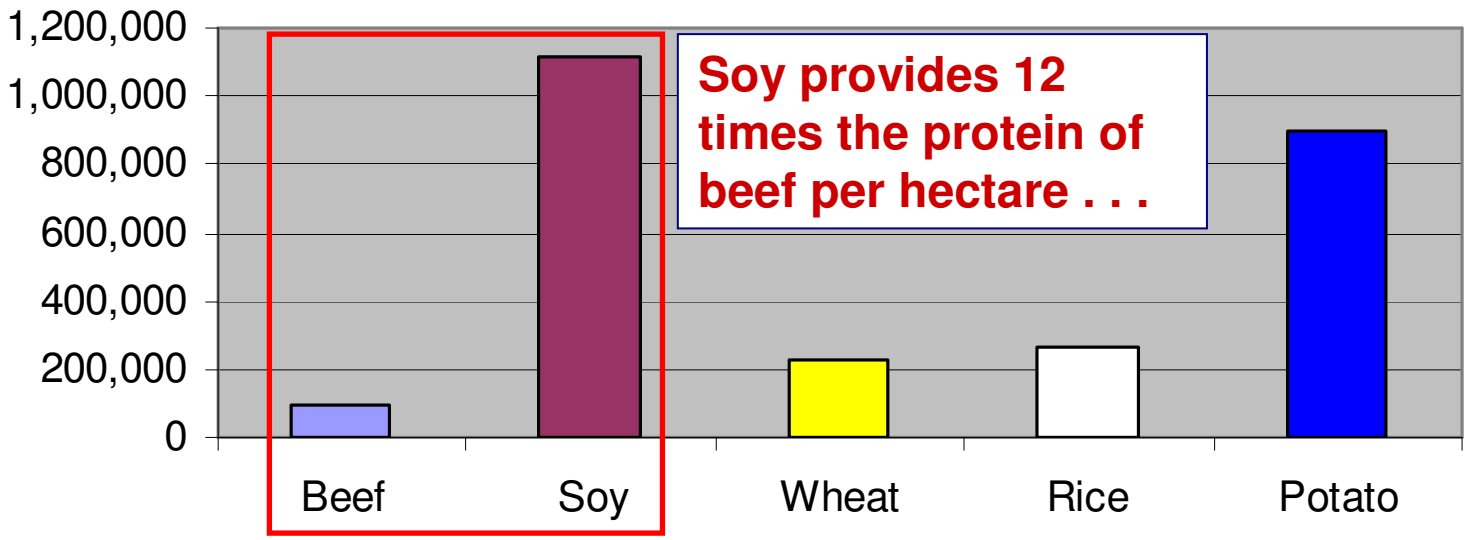
Note:

An Amino Acid Score of 100 or more indicates a complete or high-quality protein.

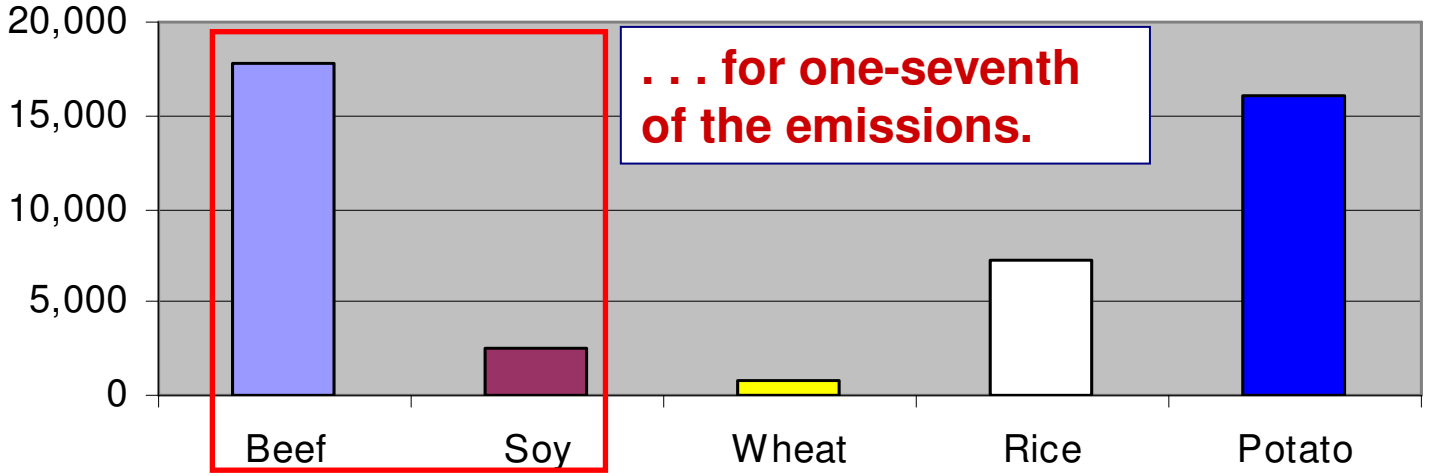
Source: Self Nutrition Data, http://nutritiondata.self.com/. (Derived from USDA Nutritional database for standard reference.)

Livestock

Protein (g) per hectare



GHG per hectare



Source: Mahony, P, *"Some Environmental Impacts of Animal Agriculture, Part 2"*, updated Dec, 2010, http://dl.dropbox.com/u/1097247/bccag/images/animals2.pdf and Mahony, P for Vegetarian Network Victoria *"Submission in Response to Victorian State Government's Climate Change Green Paper"*, Sep 2009, http://www.vnv.org.au/site/files/submission090921climatechangegreenpaper.pdf

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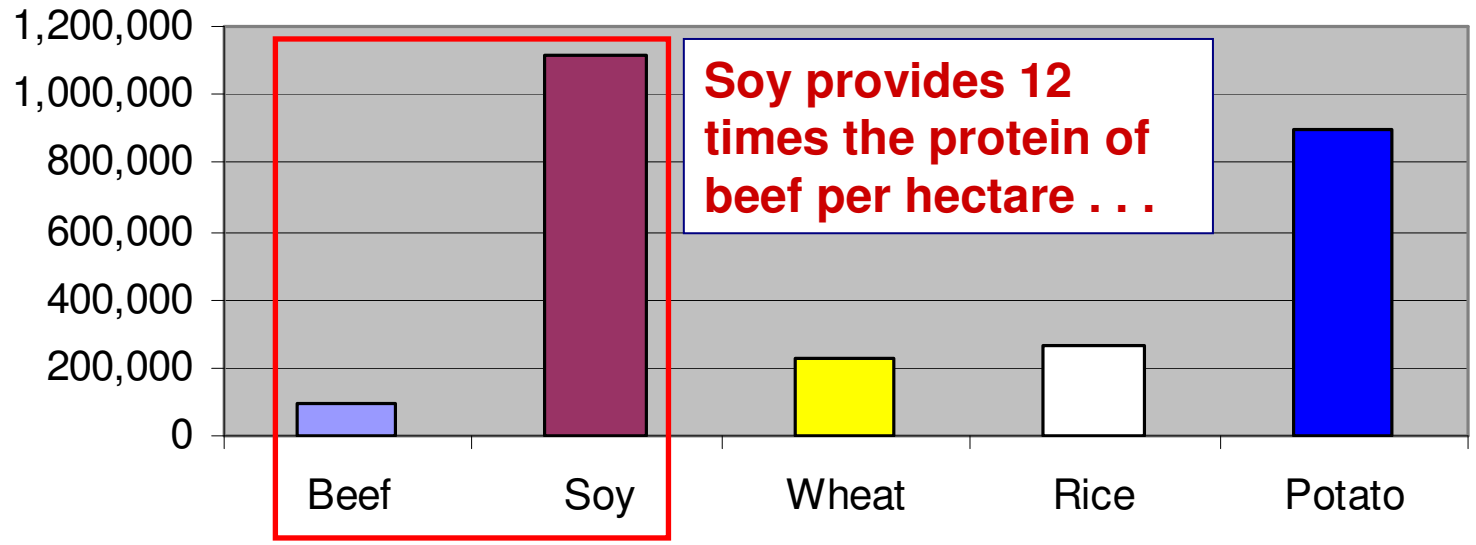
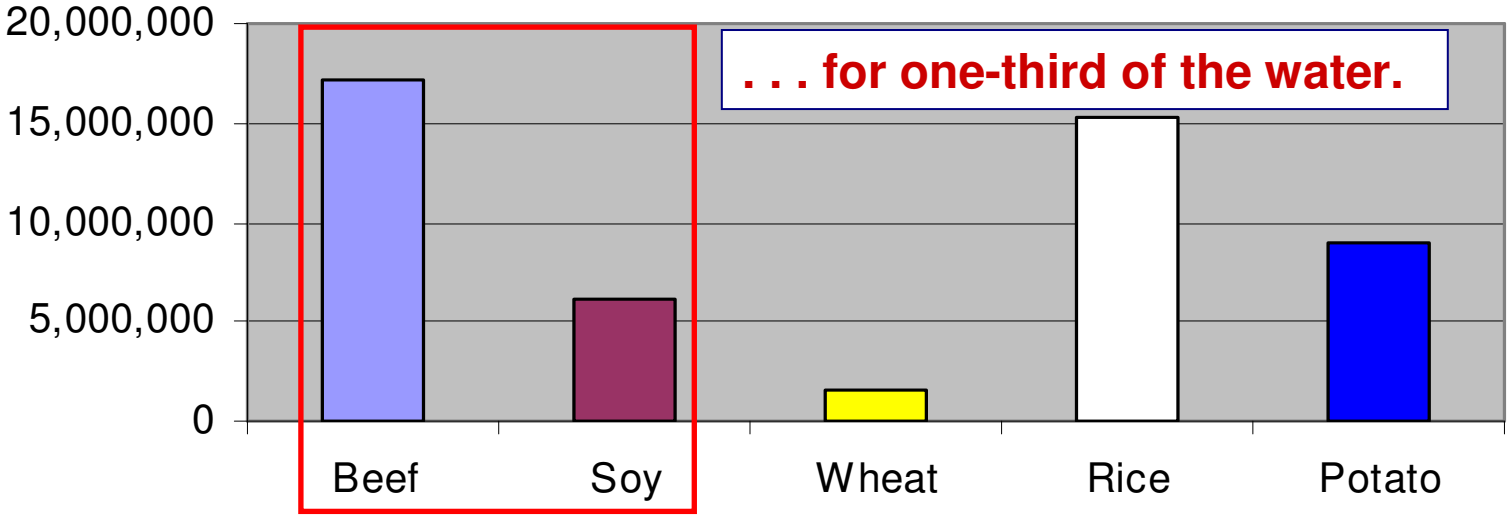


Water per hectare



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Similar results for iron, zinc, calcium, omega-3 (ALA) and energy

What about Vitamin B12?

- One source is bacteria which can be found in soil and in the digestive systems of some animals.
- B12 analogues are found in certain fungi and algae, although not always beneficial to humans.
- It can also be produced directly from bacteria as a dietary supplement.
- That is a more natural approach than destroying natural environments and killing livestock.

See:

http://animalliberation.org.au/blog/98-vitamin-b12-fuss.html (Russell, G.)
http://www.vegetarianvictoria.org.au/cms/infosheets/9veganismandvitaminb12.pdf (Ogilvie, D.)

Livestock

Other issues

- **Fish:**
- Ocean habitats are being destroyed by industrial fishing.
- 36% - 50% of the global catch is fed to livestock.
- Pigs & chickens eat 6 times as much seafood as Americans.
- **Kangaroo:** Difficult to farm and insufficient yield for mass consumption.
- **Chicken:** See above re seafood. Also corn and nitrogen-based fertilizer contributing to oceanic dead zones. Also inherently inefficient relative to a plant-based diet.
- **Dairy:** Is it natural? We are the only species that consumes the milk of other species, and the only one that consumes milk beyond a young age.
- **Vested interests**
- **Environmental groups**
- **Political expediency**
- **Aid agencies promoting livestock donations**
- **Cultural and social conditioning, blind spots and blinkers**

Livestock

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BUT IT'S AN EMERGENCY!

What can we do?

Corporations:

- Modify dining and entertaining practices.

Individuals:

- Consume fewer livestock products.

- Inform others.

Environmental Groups:

- Make animal agriculture a high priority.

Governments:

- Utilise pricing factors, e.g. carbon tax.

- Inform the community.

- Modify dining and entertaining practices.

Livestock

Do you have to miss out on delicious food?

Not at all.

See:

www.veganeasy.org

www.vegetarianvictoria.org.au/recipes.html

www.vegetarianvictoria.org.au/healthy-living/healthy-living.html

Review of key messages - General

Climate change is real

Human activity is having a massive impact

Review of key messages – Livestock

Inherent inefficiency

Scale

Greenhouse gases and other warming agents

Deforestation

Nutrition

Livestock needs to be part of the main game

Concluding message

- *" . . . if we could recognise who we really are*
- *rather than beings who were magically and separately created from the rest of nature,*
- *and if we could come to grips with that reality,*
- *then maybe we could be aroused from the stupor that we find ourselves in and begin to save ourselves."*

Source: Ann Druyan, co-author with late husband Carl Sagan of "Shadows of forgotten ancestors" interviewed on Late Night Live, ABC Radio National, Australia, 13 Dec, 2007