OMISSION OF EMISSIONS: LIVESTOCK AND THE CLIMATE CRISIS

Paul Mahony
October 2013

Main Image: M. Todesco, Cryospheric Processes Laboratory, City College New York City, http://cryocity.org/

Presentation outline

Our warming planet

The Arctic "big melt"

Extreme weather events

Livestock:

Inherent inefficiency

Scale

Greenhouse gases and other warming agents

Land clearing and degradation

Nutrition

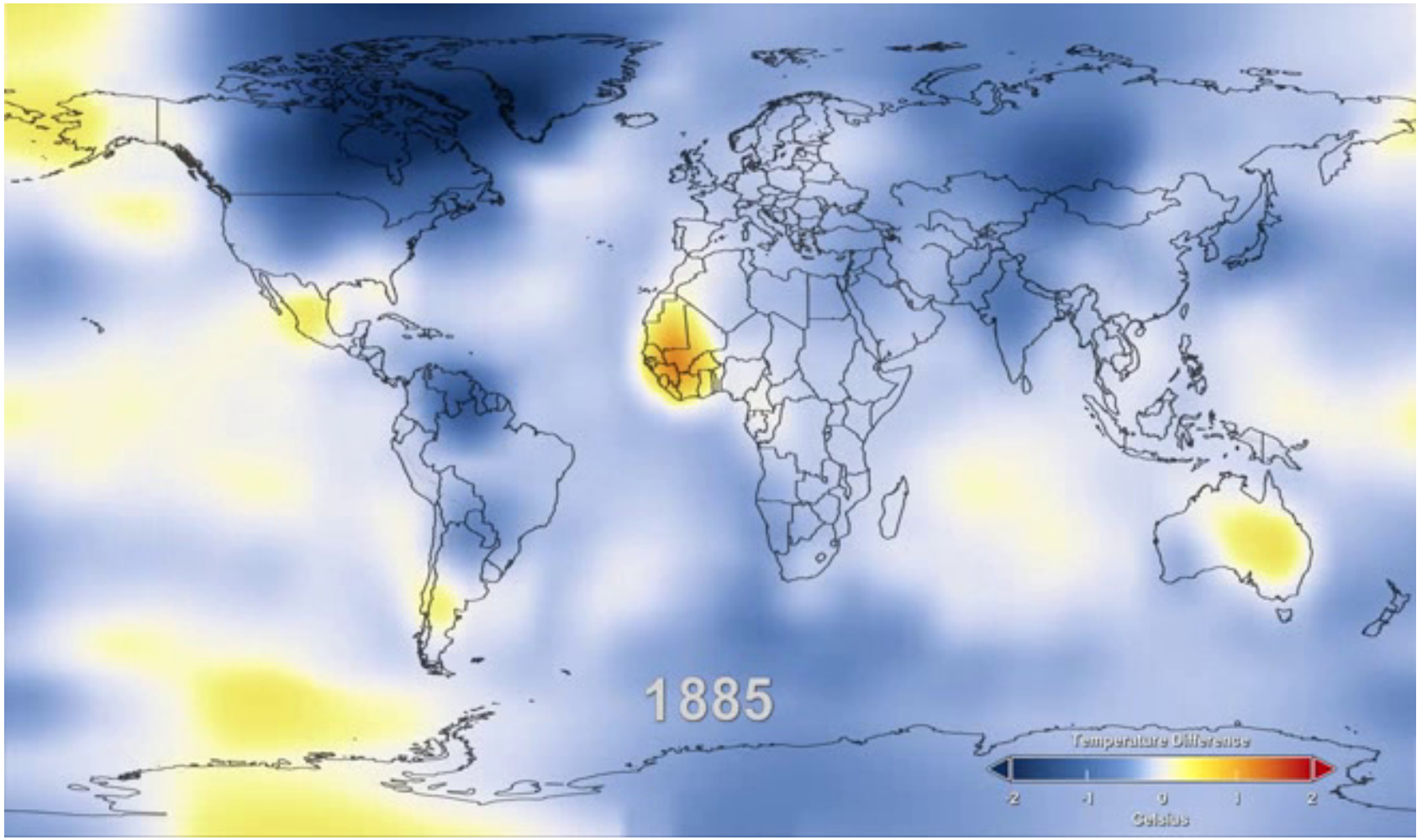
Inter-related

Conclusion: This is an emergency!

For more information

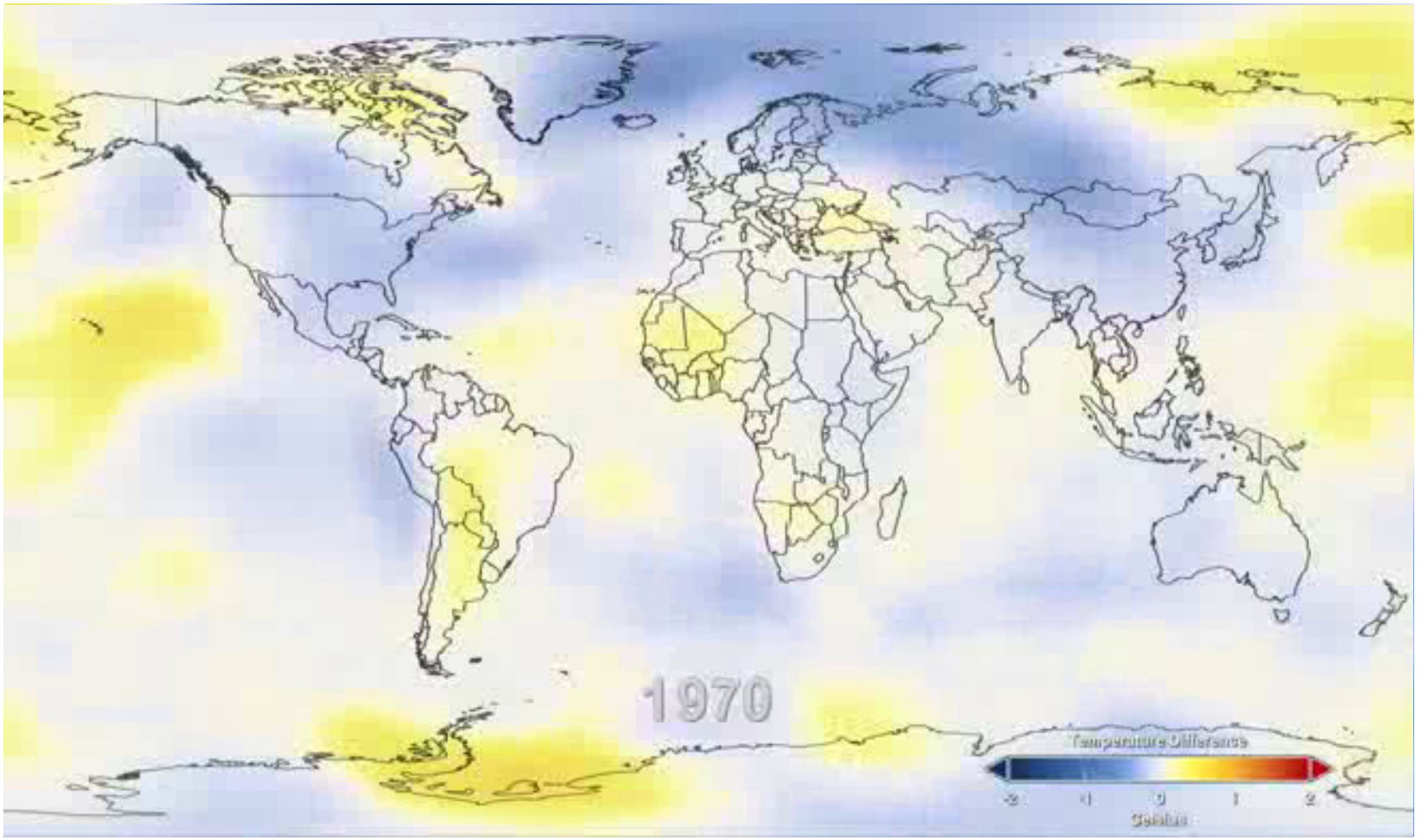
terrastendo.net

Our warming planet



http://www.nasa.gov/multimedia/videogallery/index.html?media_id=123437001

Our warming planet



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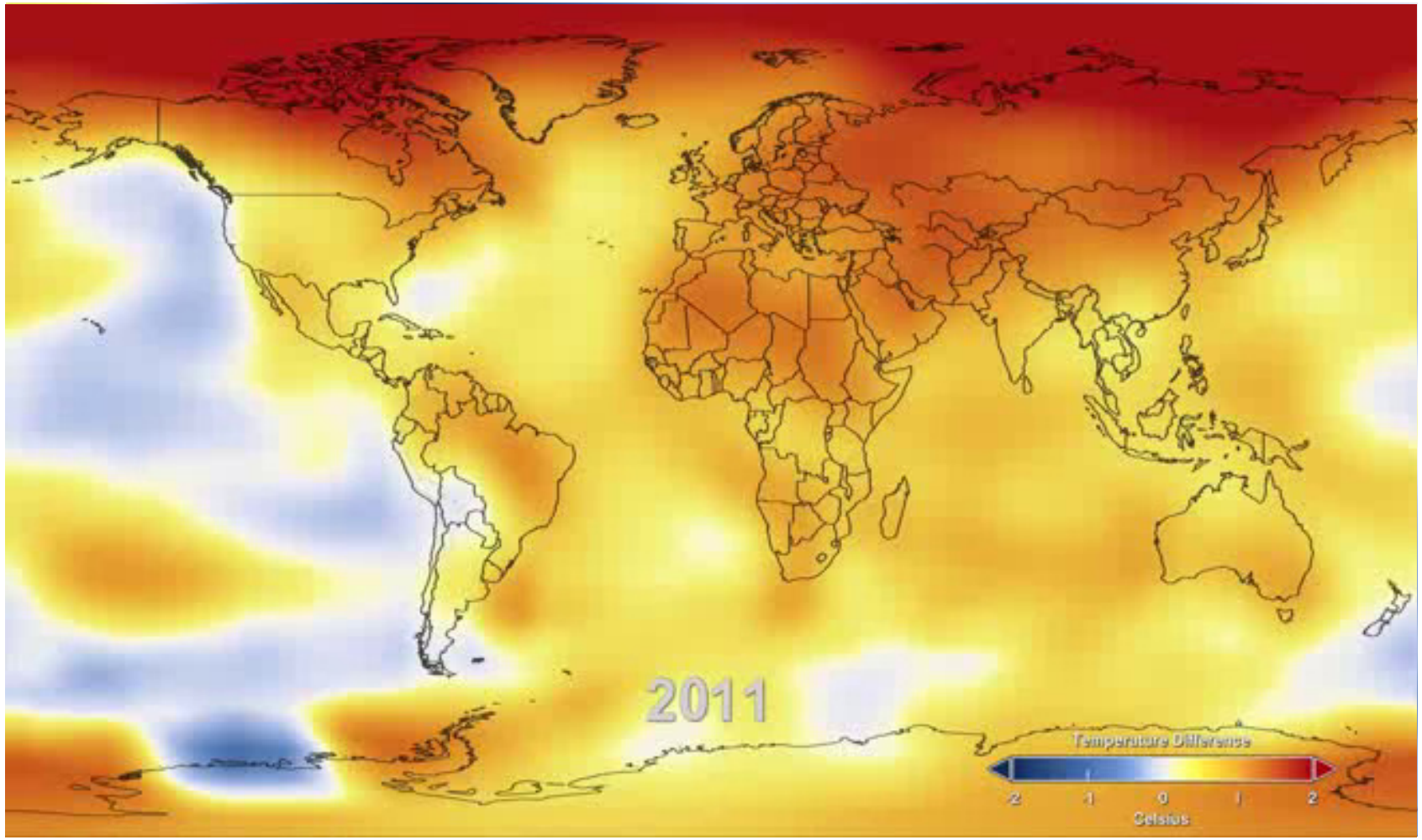

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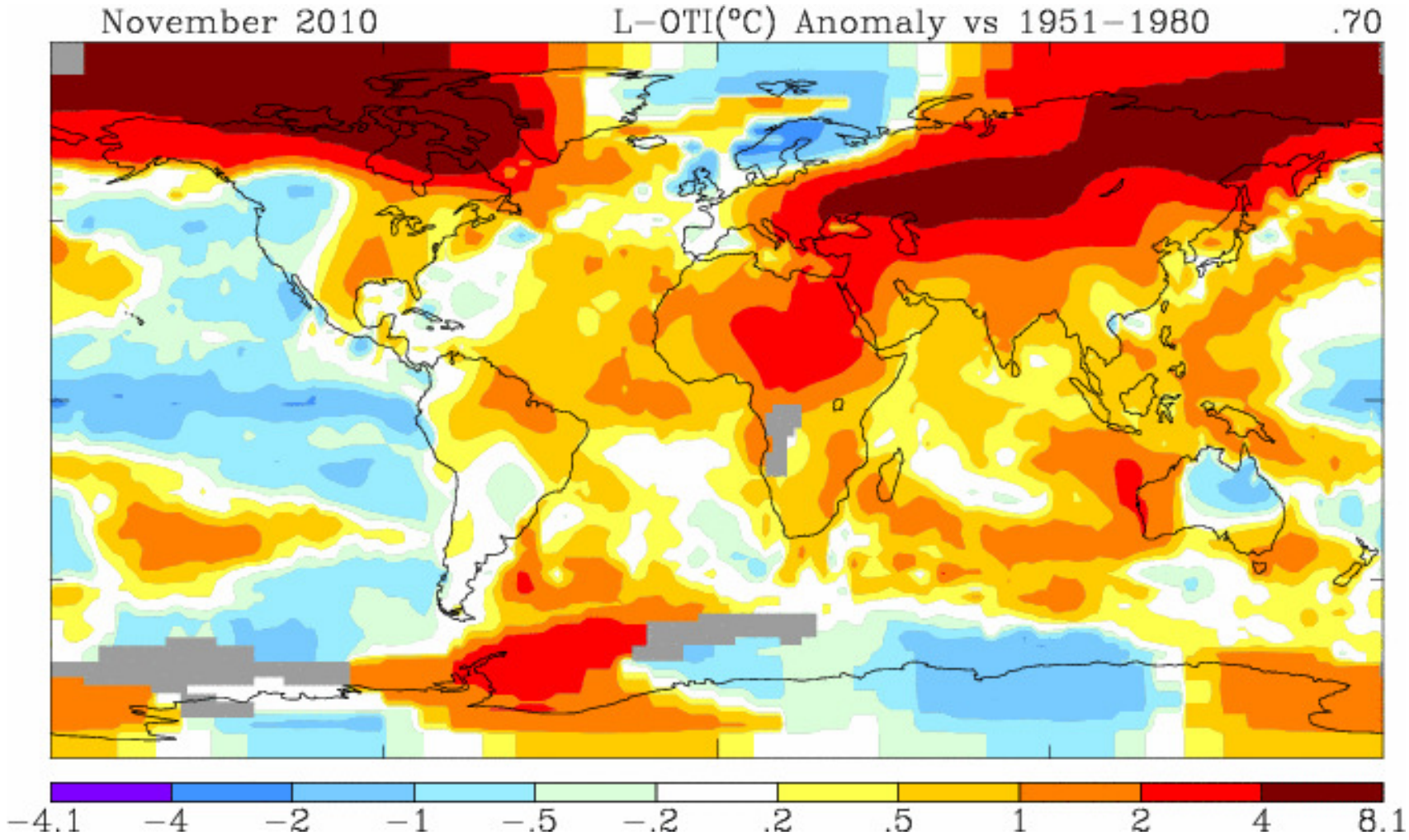
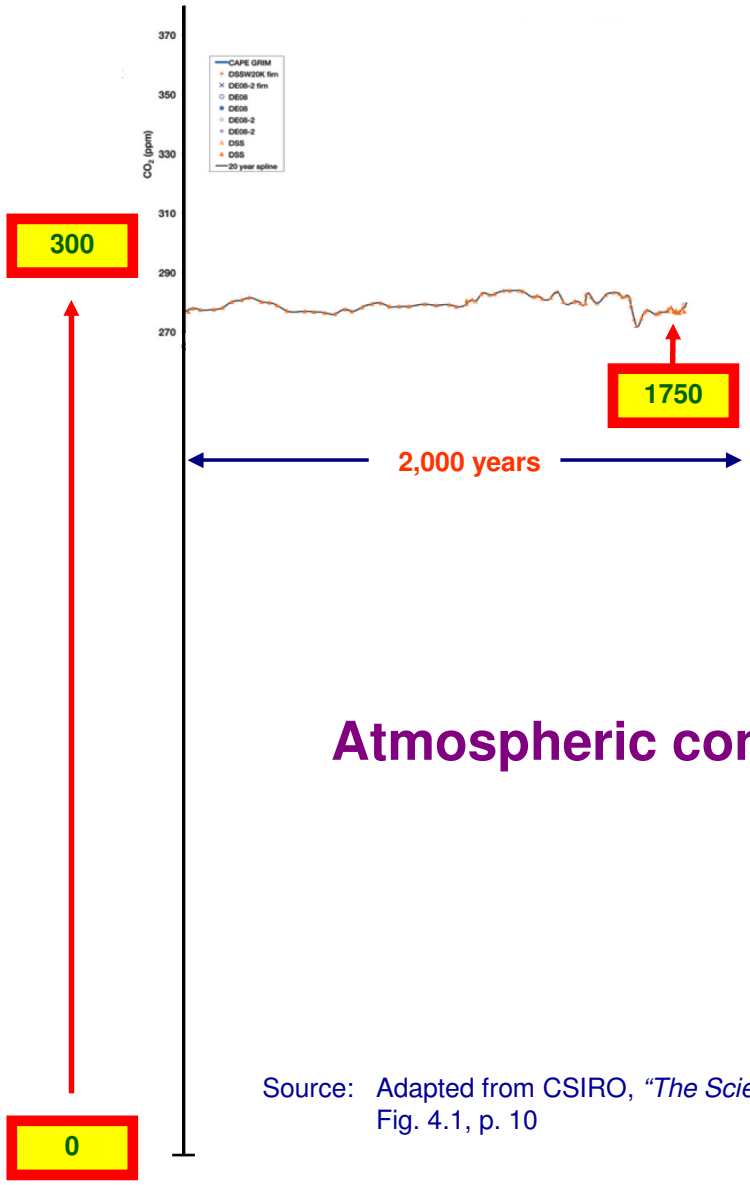


NASA Goddard Institute for Space Studies Surface Temperature Analysis, http://data.giss.nasa.gov/cgi-bin/gistemp/do_nmap.py?year_last=2012&month_last=1&sat=4&sst=1&type=anoms&mean_gen=11&year1=2010&year2=2010&base1=1951&base2=1980&radius=1200&pol=reg

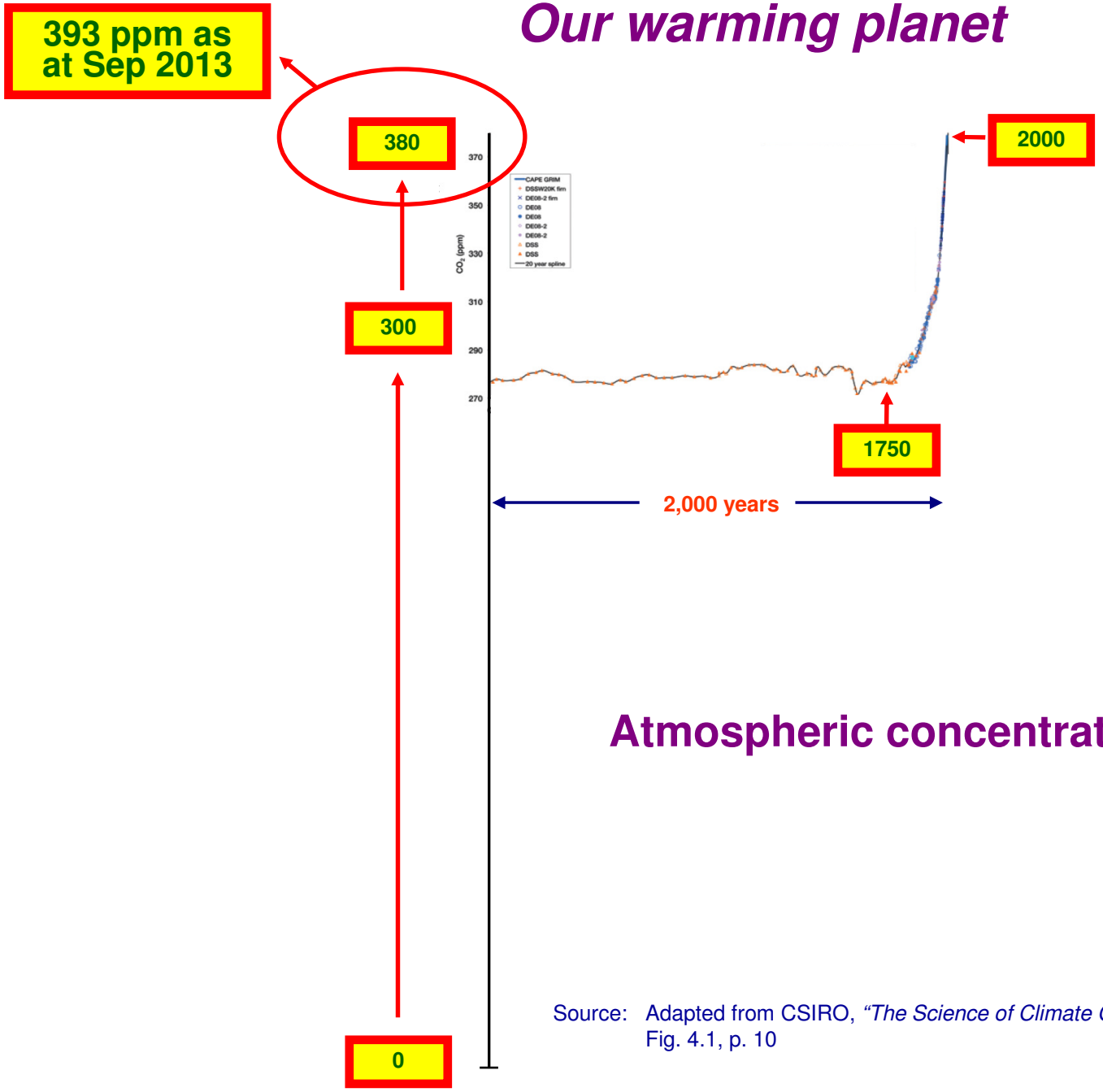
Our warming planet



Atmospheric concentrations of CO2

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

Our warming planet



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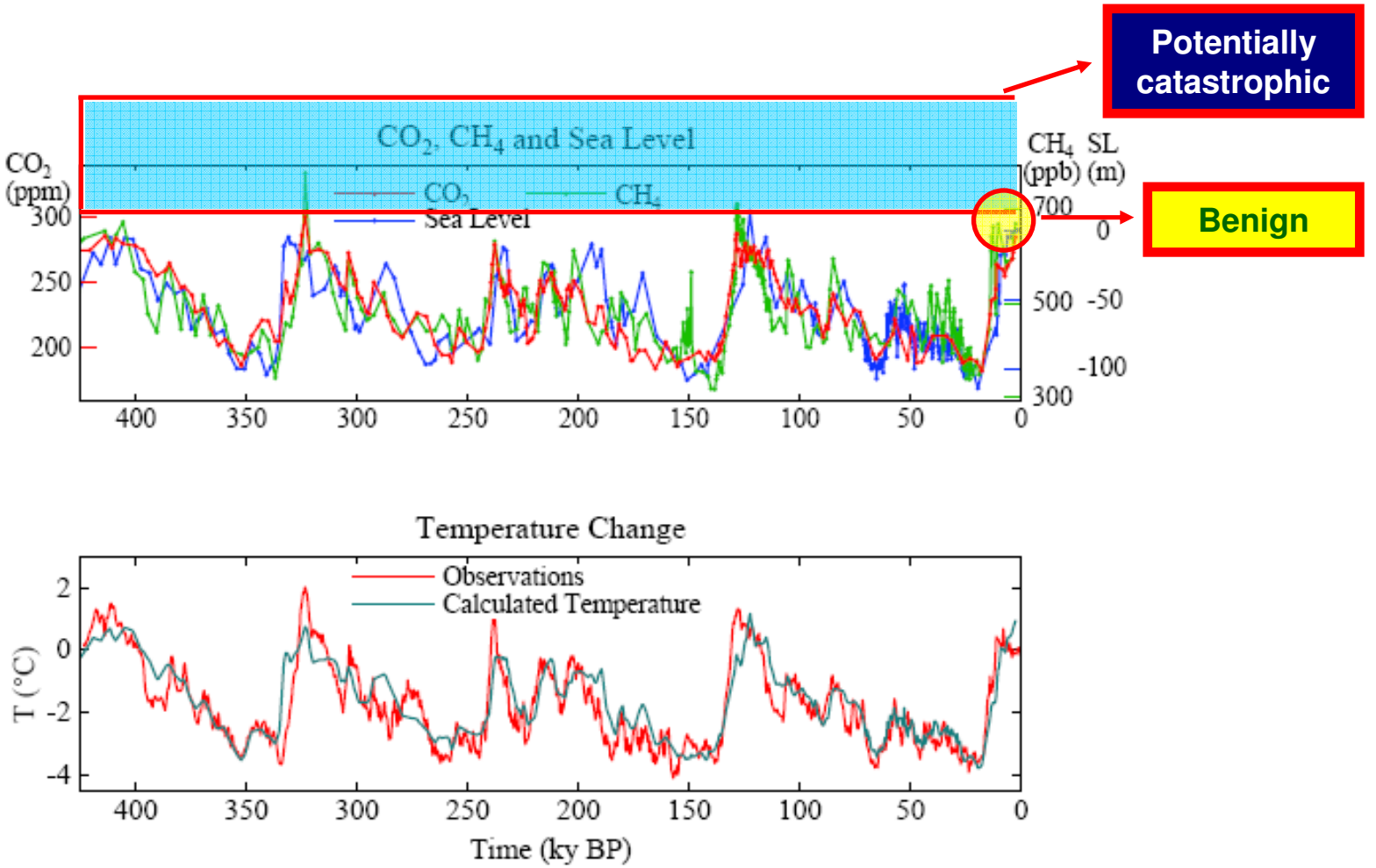
GHGs, sea levels and temperature

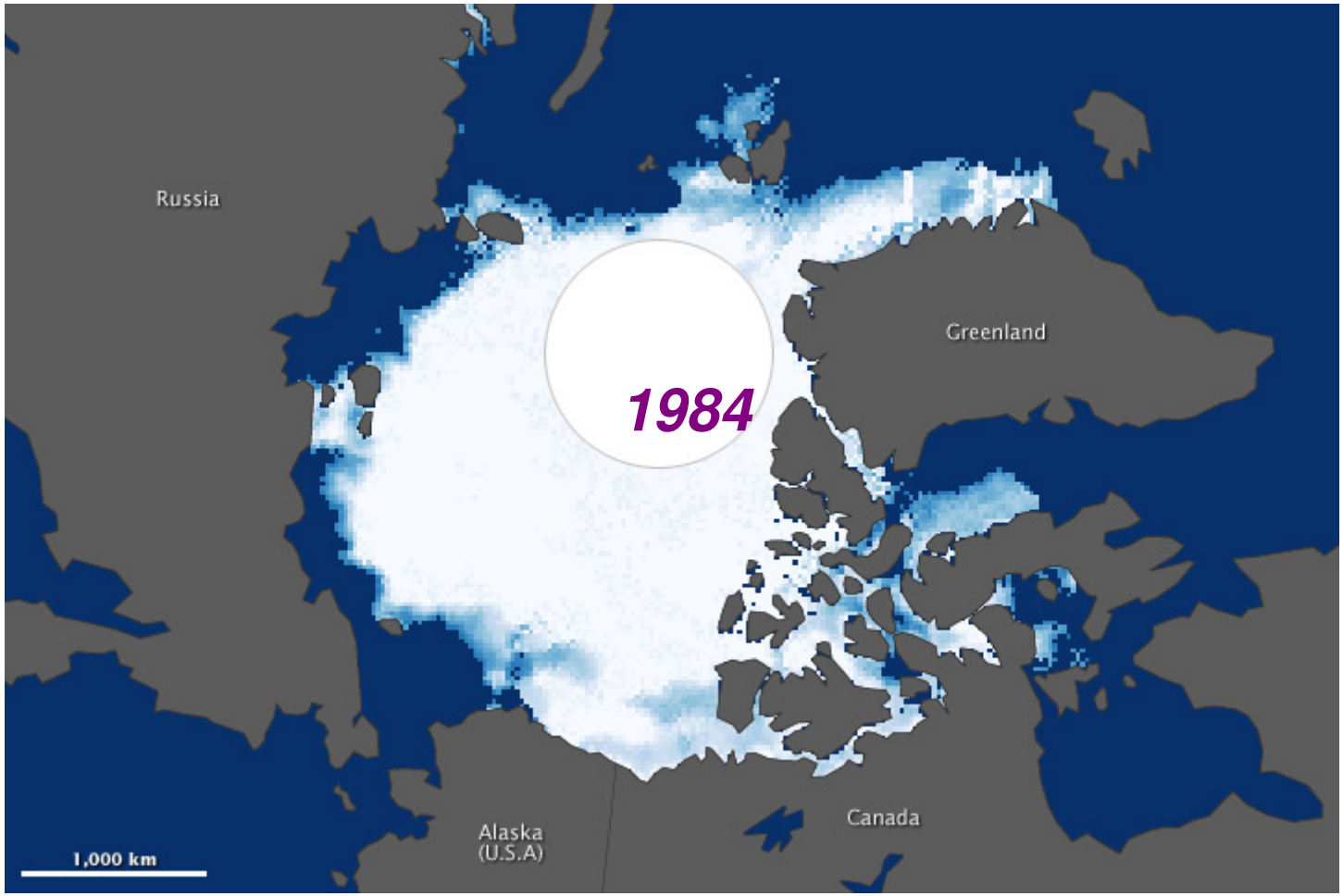


<u>Note</u>: The shaded circle includes the 10,000 years (approx.) of human civilisation.

Source: Hansen, J. et al "Target Atmospheric CO2: Where Should Humanity Aim?", 2008

http://pubs.giss.nasa.gov/abstracts/2008/Hansen_etal.html

The Arctic "Big Melt"



NASA Earth Observatory, http://earthobservatory.nasa.gov/IOTD/view.php?id=79256&src=eorss-iotd

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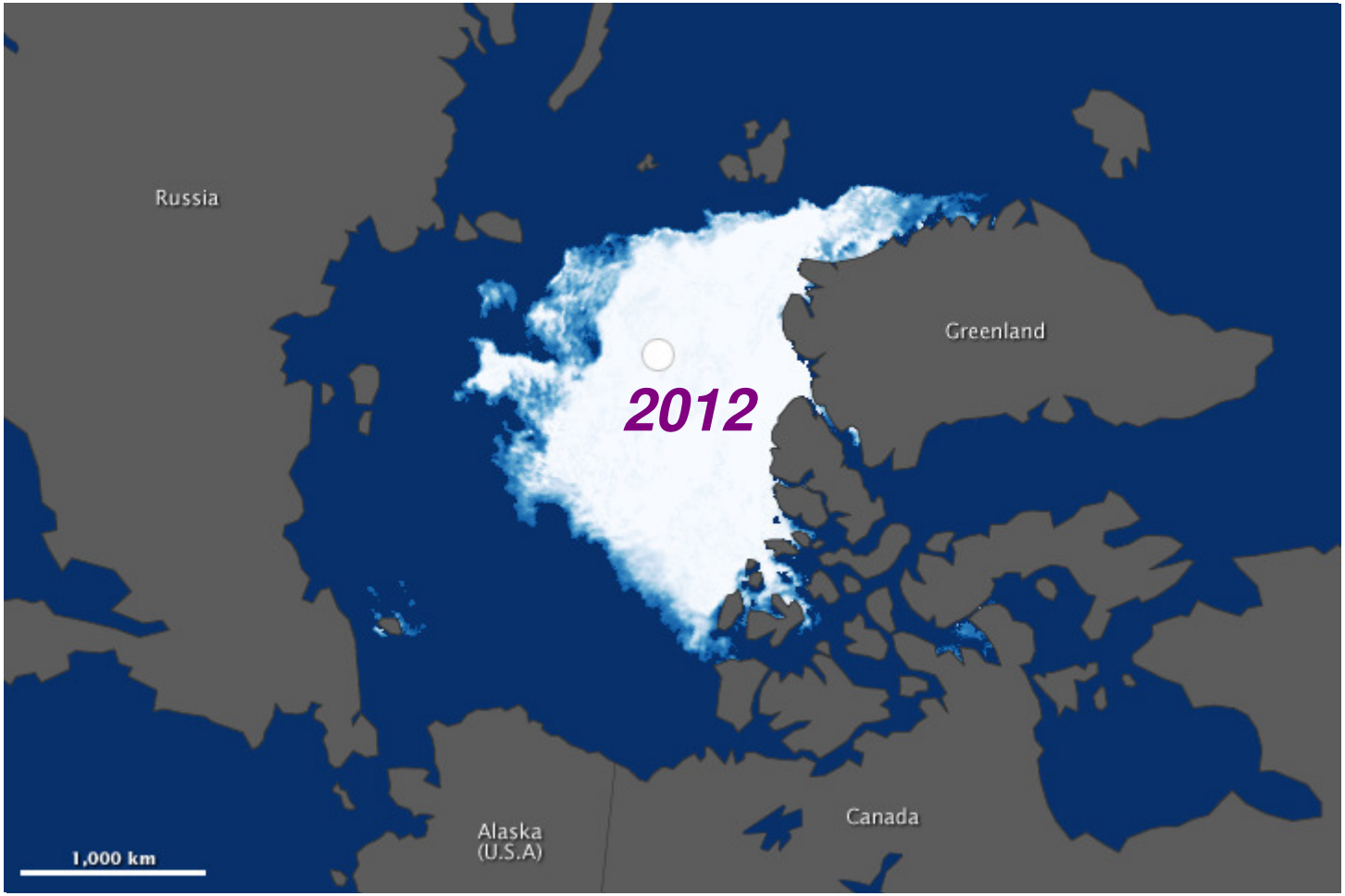

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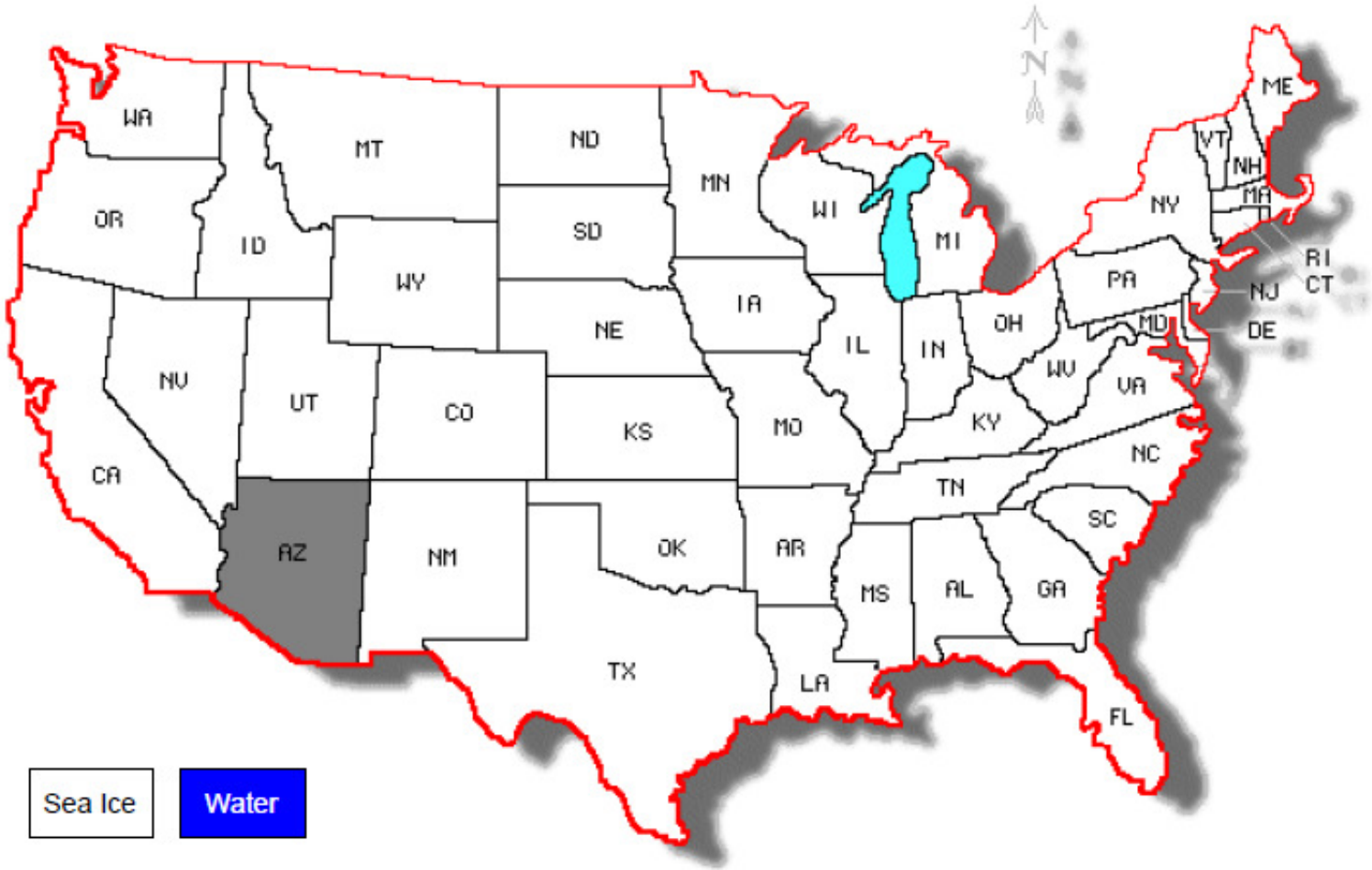
Equivalent to (next slide)



Walt Meier, National Snow and Ice Data Center, *"Record Low Arctic Sea Ice Extent in 2012: An exclamation point on a long-term declining trend"* http://www.nws.noaa.gov/om/csd/content/seminars/semser_20120912_meier_walt/semser_20120912_meier_walt_1.pdf (Slide 8)

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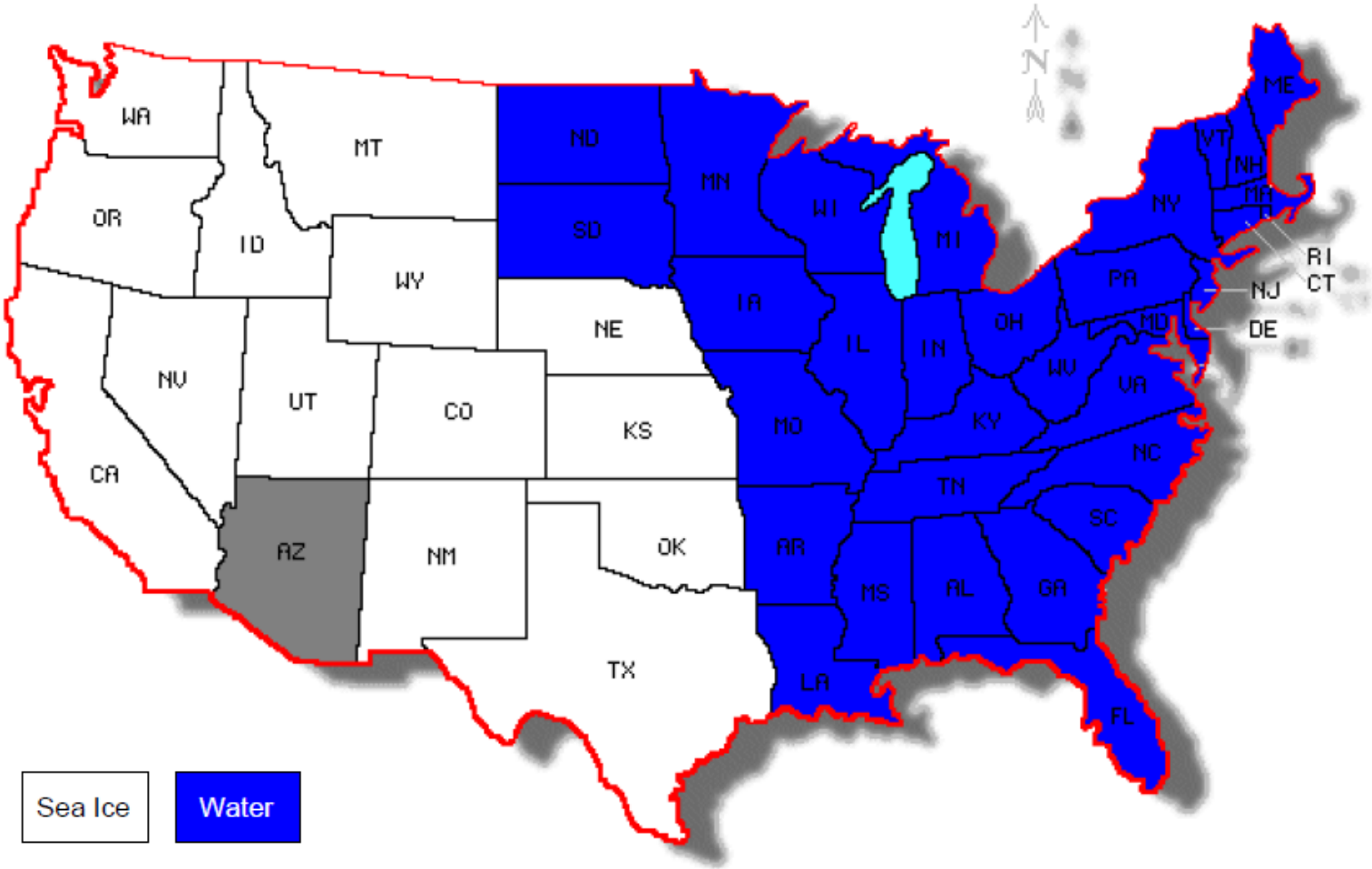

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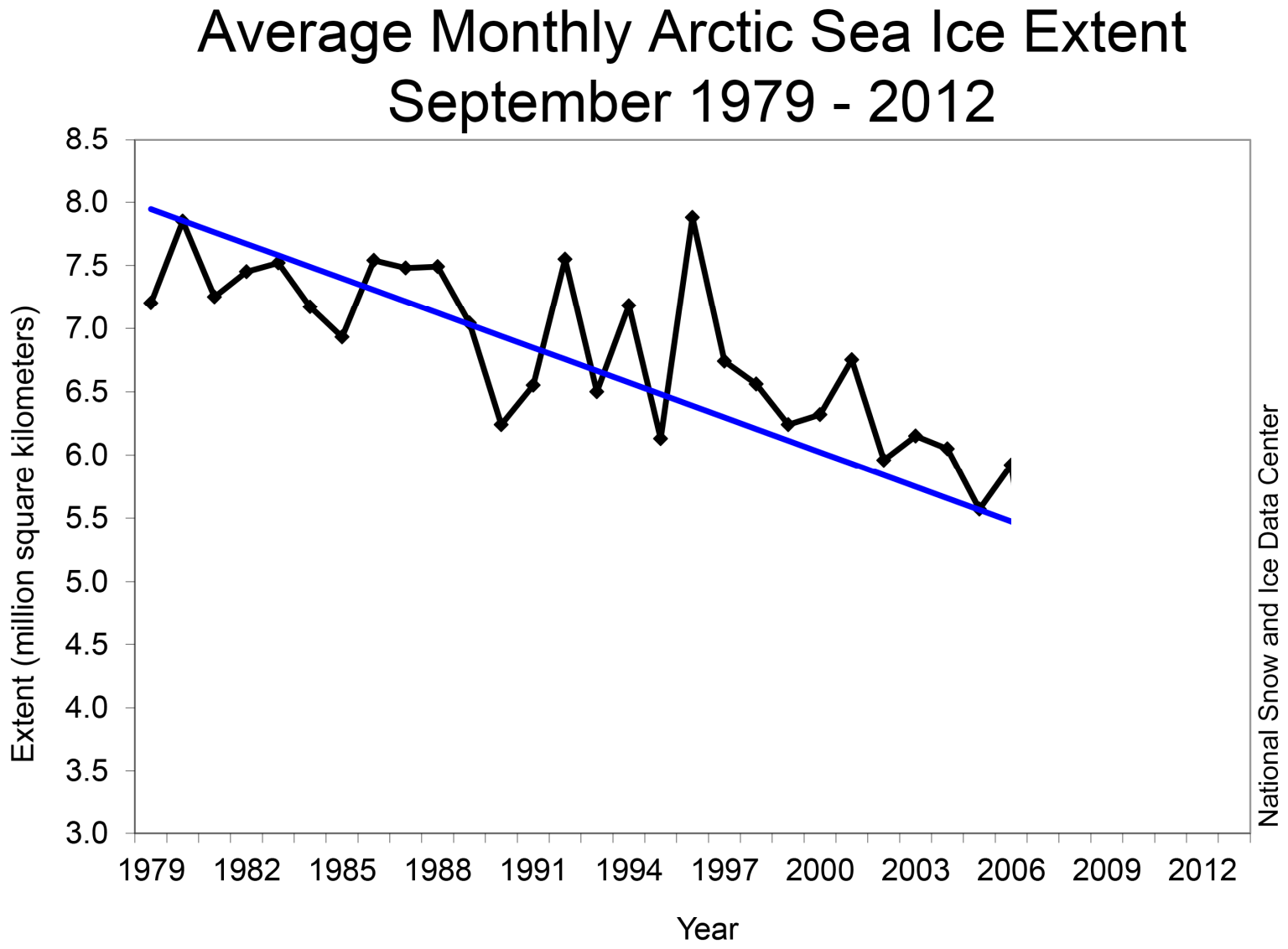
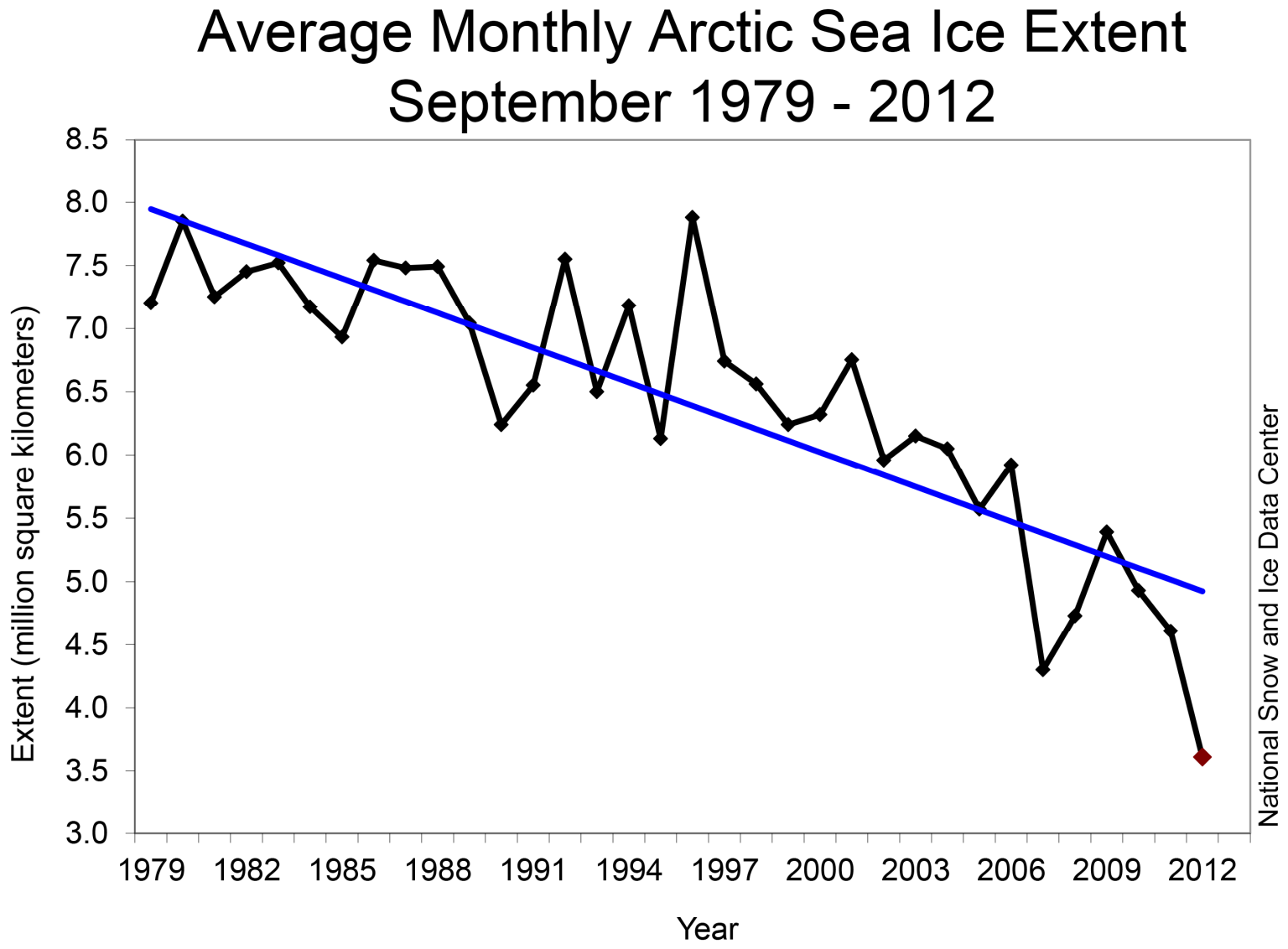


National Snow & Ice Data Center, September 2012 compared to previous years, http://nsidc.org/arcticseaicenews/2012/10/poles-apart-a-record-breaking-summer-and-winter/

The Arctic "Big Melt"



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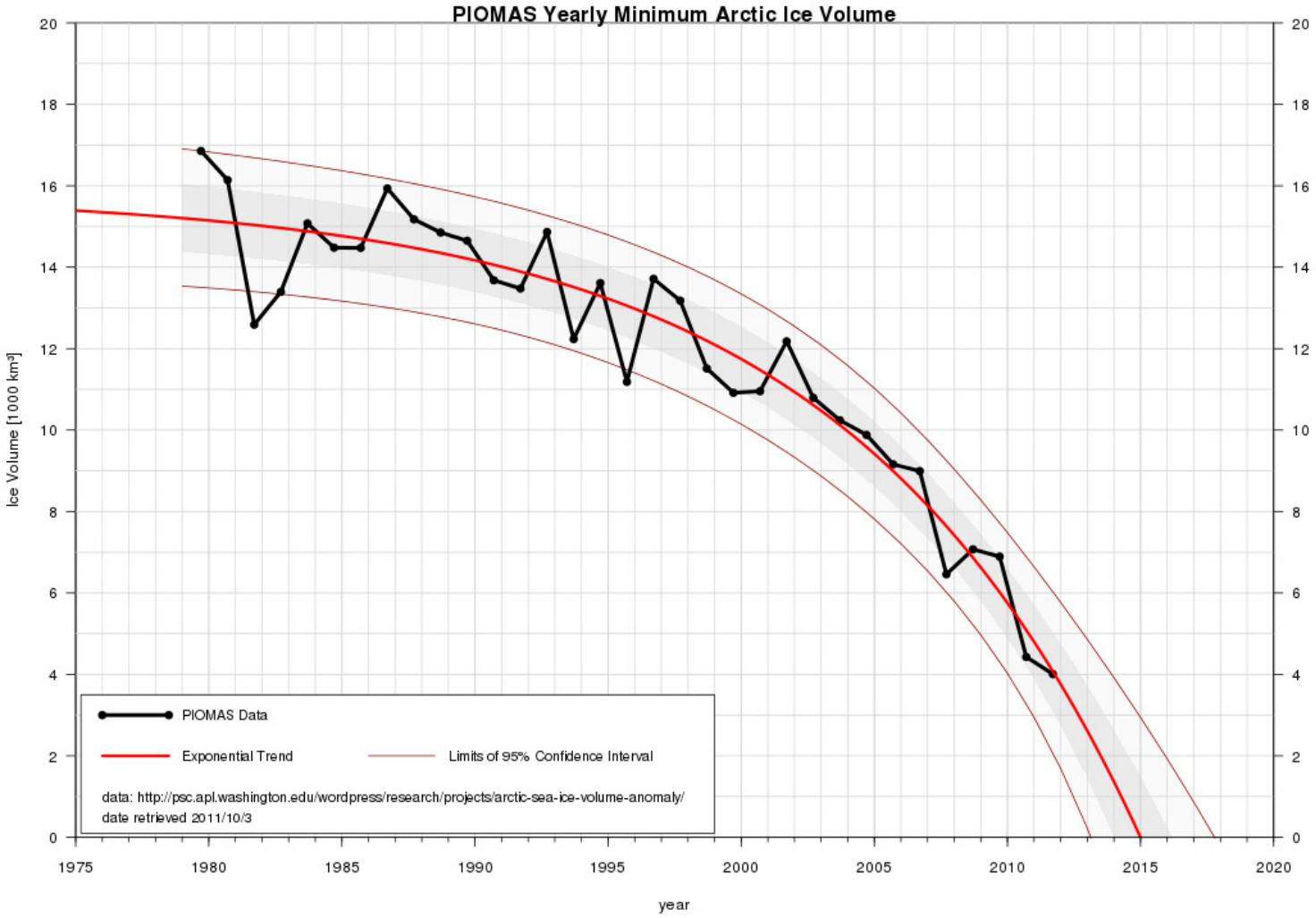


From Brook, B. *"Depressing climate-related trends – but who gets it?"*, 6 Nov 2011 http://bravenewclimate.com/2011/11/06/depressing-climate-trends/ based on Pan-Arctic Ice Ocean Modeling and Assimilation System (PIOMAS, Zhang and Rothrock, 2003) graphs from the Polar Science Center of the Applied Physics Laboratory at the University of Washington, http://psc.apl.washington.edu/wordpress/research/projects/arctic-sea-ice-volume-anomaly/, reported in http://neven1.typepad.com/blog/2011/10/piomas-september-2011-volume-record-lower-still.html

The Arctic "Big Melt"

Volume (area and thickness)

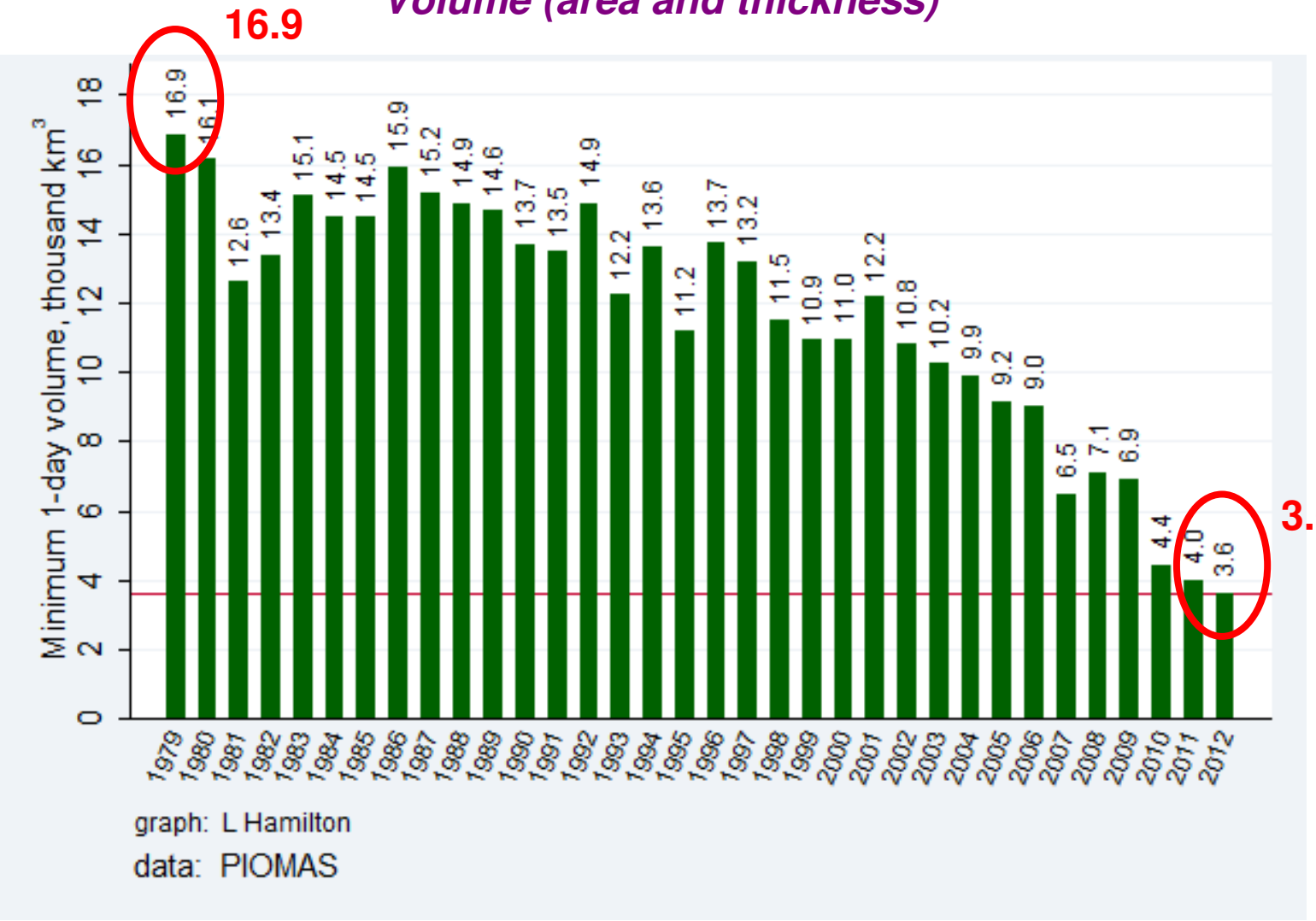
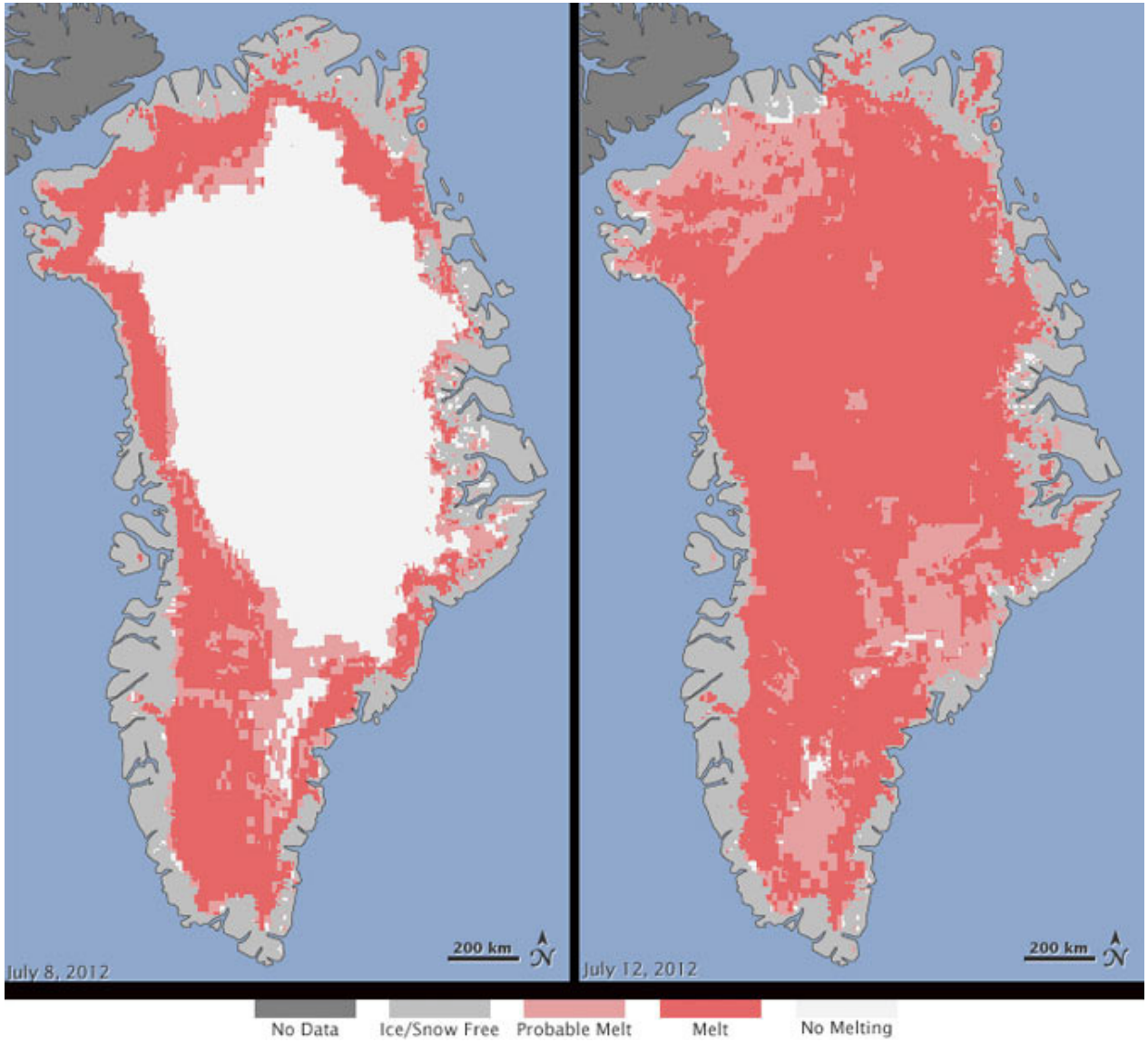


Chart by L. Hamilton, based on Pan-Arctic Ice Ocean Modeling and Assimilation System (PIOMAS) data from the Polar Science Center http://psc.apl.washington.edu/wordpress/research/projects/arctic-sea-ice-volume-anomaly/, cited in Romm, J, "Experts Warn Of 'Near Ice-Free Arctic In Summer' In A Decade", 6 September, 2012, The Energy Collective, http://theenergycollective.com/josephromm/110216/death-spiral-watch-experts-warn-near-ice-free-arctic-summer-decade-if-volume-trend

The Arctic "Big Melt"

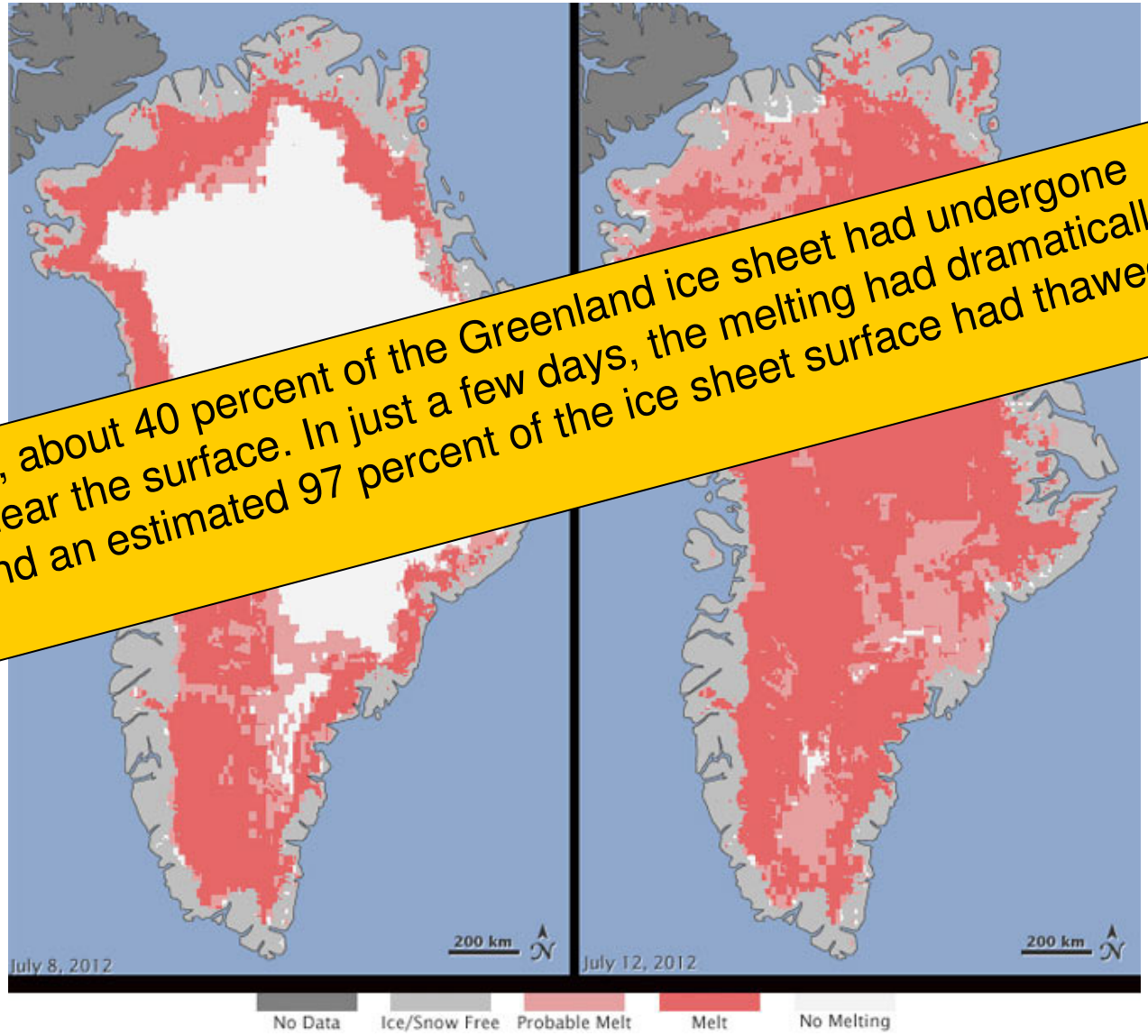


http://www.nasa.gov/topics/earth/features/greenland-melt.html

"Greenland Melting Breaks Record Four Weeks Before Season's End", ScienceDaily, 15 August, 2012, http://www.sciencedaily.com/releases/2012/08/120815121318.htm

The Arctic "Big Melt"

On 8 July 2012, about 40 percent of the Greenland ice sheet had undergone thawing at or near the surface. In just a few days, the melting had dramatically accelerated and an estimated 97 percent of the ice sheet surface had thawed by July 12.



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Greenland Ice Sheet

Scale comparison of Greenland (the largest island) and Australia (the smallest continent) by Joanna Serah, 26 Oct 2011, http://en.wikipedia.org/wiki/File:Australia-Greenland_Overlay.png

Greenland Ice Sheet

M. Todesco, Cryospheric Processes Laboratory, City College New York City, http://cryocity.org/

Greenland Ice Sheet

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Greenland Ice Sheet

Graphic video of Greenland torrents cascading down a moulin or crater to the base: http://www.youtube.com/watch?v=lGxLs8YV9MM

As of 2009, the Greenland ice sheet was losing over 250 cubic kilometres of ice per year in a dynamic wet melting process, after neither gaining nor losing mass at a substantial rate as recently as the 1990's.

This dynamic melting process is not taken into account in the IPCC's projections of sea level rise. (Refer to subsequent slides.)

Video: M. Todesco, Cryospheric Processes Laboratory, City College New York City, http://cryocity.org/
Comments on loss of ice mass: Hansen, J., *"Storms of my grandchildren",* Bloomsbury, pp. 255-256 and p. 287. (An alternative ice loss figure to the quoted figure of 250 cubic km from p. 287 had been shown on p. 255 but the correct figure has been confirmed as 250 cubic km in emails of 15th and 16th June, 2011.)

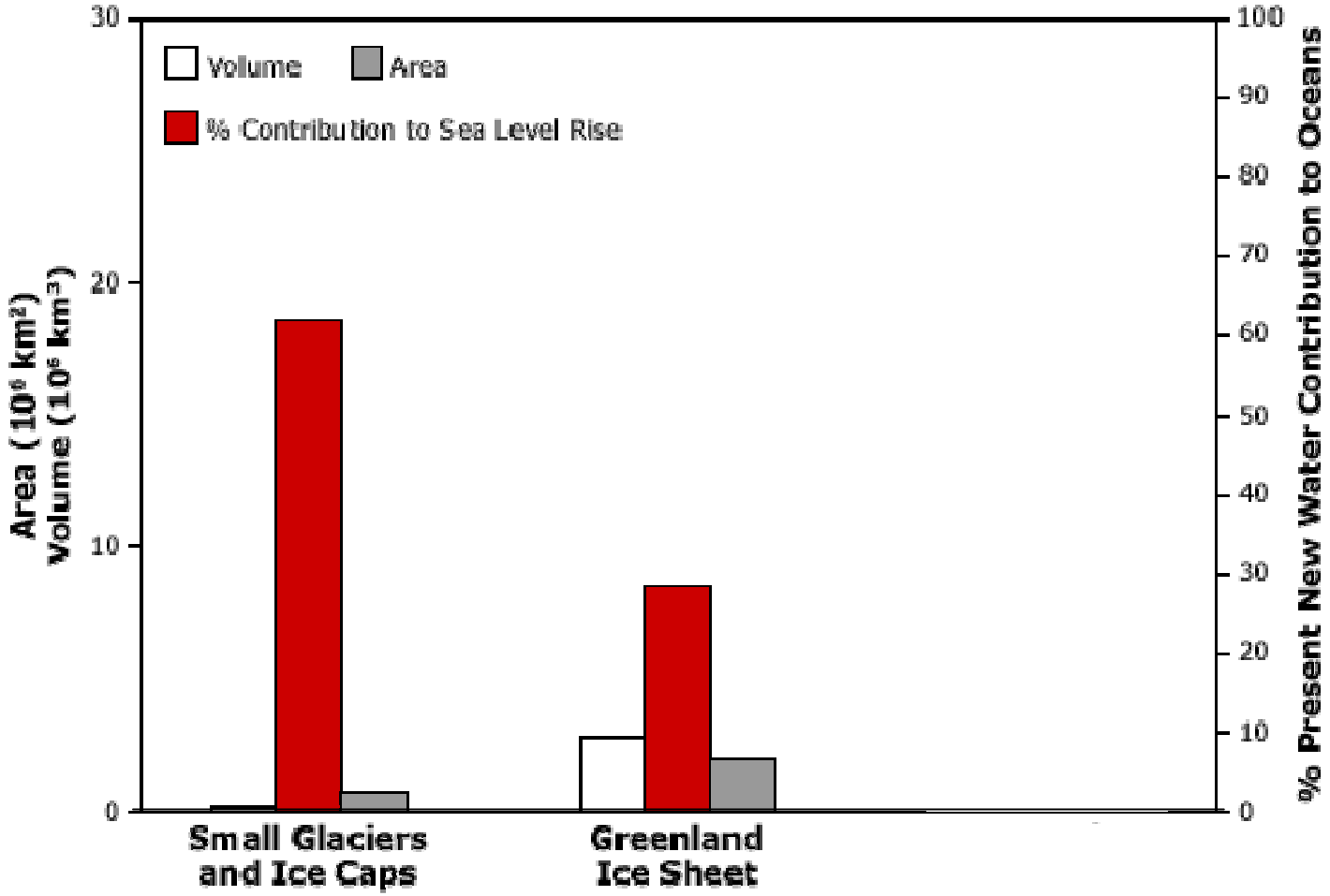
Greenland Ice Sheet

If the annual water flows were poured over Germany . . .

Based on ice mass loss of 250 cubic km per annum

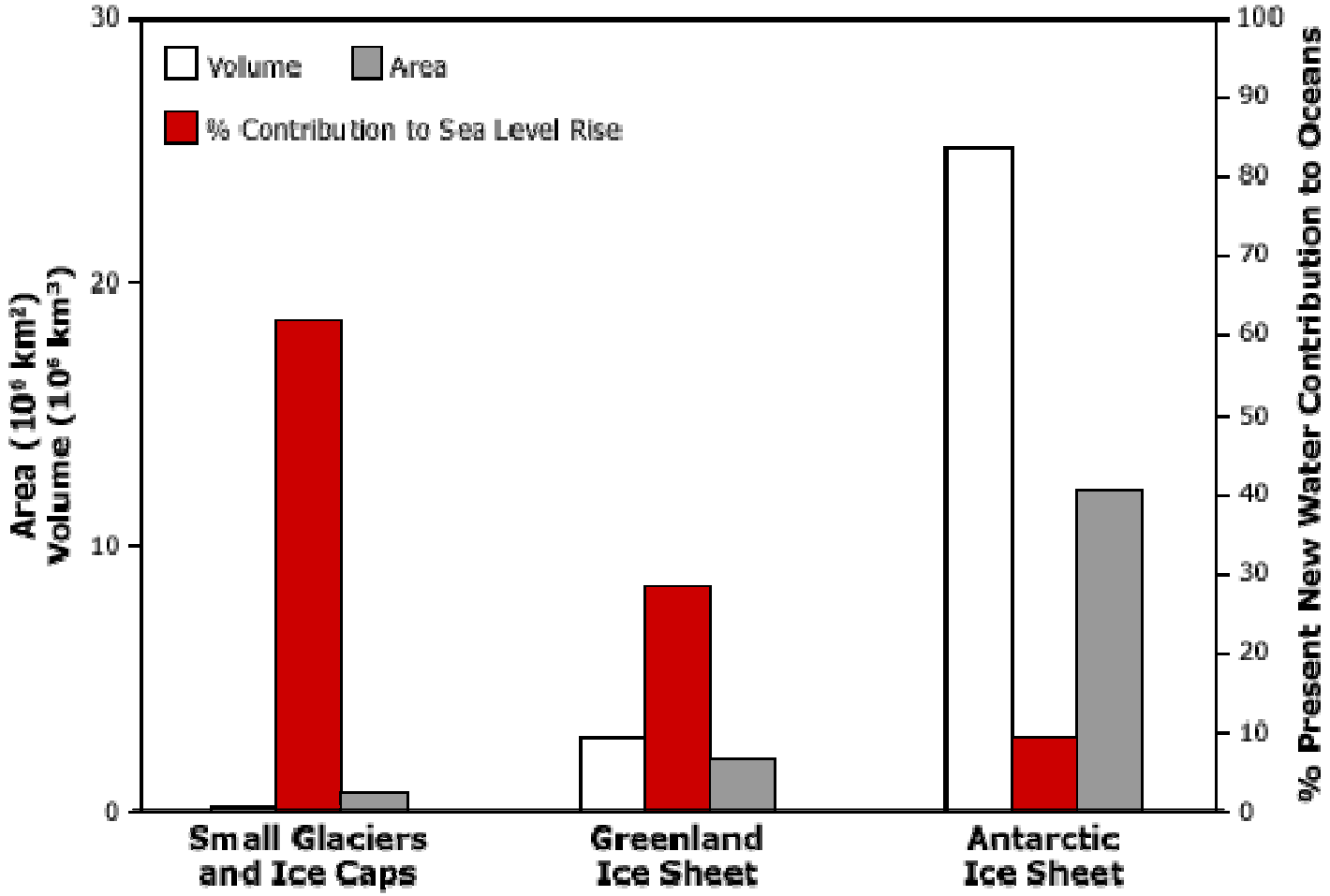
0.71 metres

All Ice Sheets and Glaciers



NSIDC, "The Contribution of the Cryosphere to Changes in Sea Level", http://nsidc.org/cryosphere/sotc/sea_level.html

All Ice Sheets and Glaciers



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Global sea level rise

Projections to 2100:

IPCC:	Up to 1 metre (but higher values cannot be excluded)
Vermeer and Rahmstorf:	nearly 2 metres
Hansen:	Likely several metres (see next slide) if we continue with "business as usual", depending on impact of negative (diminishing) feedbacks.

Impacts:

Experienced through **"high sea-level events"** .

A combination of sea-level rise, high tide and storm surge.

Increased likelihood with **0.5 of a metre**: **100 to 1,000 fold increase**

Steffen, W, *"The Critical Decade: Climate Science, risks and responses"*, Climate Commission, Fig. 8, p. 12 http://climatecommission.gov.au/topics/the-critical-decade/

Spratt, D, "NASA climate chief demolishes denialist claims on sea levels", 26 Oct 2012, http://www.climatecodered.org/2012/10/nasa-climate-chief-demolishes-denialist.html and Hansen, J & Sato, M "Update of Greenland Ice Sheet Mass Loss: Exponential?", 26 Dec 2012

Global sea level rise

What about IPCC's projection of less than 1 metre?

Only allows for certain short feedback mechanisms, e.g. changes in:

- water vapour
- clouds
- sea ice

Does not allow for slow feedbacks, e.g.:

- ice sheet dynamics;
- changes in vegetation cover;
- permafrost melting; and
- carbon-cycle feedbacks.

Spratt, D and Sutton, P, "Climate Code Red: The case for emergency action", Scribe, 2008, p. 47

Permafrost

- **Dramatic and unprecedented plumes of methane . . . have been seen bubbling to the surface of the Arctic Ocean by scientists undertaking an extensive survey of the region.**
- **The scale and volume of the methane release has astonished the head of the Russian research team who has been surveying the seabed of the east Siberian Arctic Shelf off northern Russia for nearly 20 years.**
- **Igor Semiletov of the International Arctic Research Centre at the University of Alaska Fairbanks . . . said that he has never before witnessed the scale and force of the methane being released from beneath the Arctic seabed.**

Connor, S, "Vast methane 'plumes' seen in Arctic ocean as sea ice retreats", The Independent, 13 December, 2011, http://www.independent.co.uk/news/science/vast-methane-plumes-seen-in-arctic-ocean-as-sea-ice-retreats-6276278.html (Accessed 4 February 2012)

Permafrost

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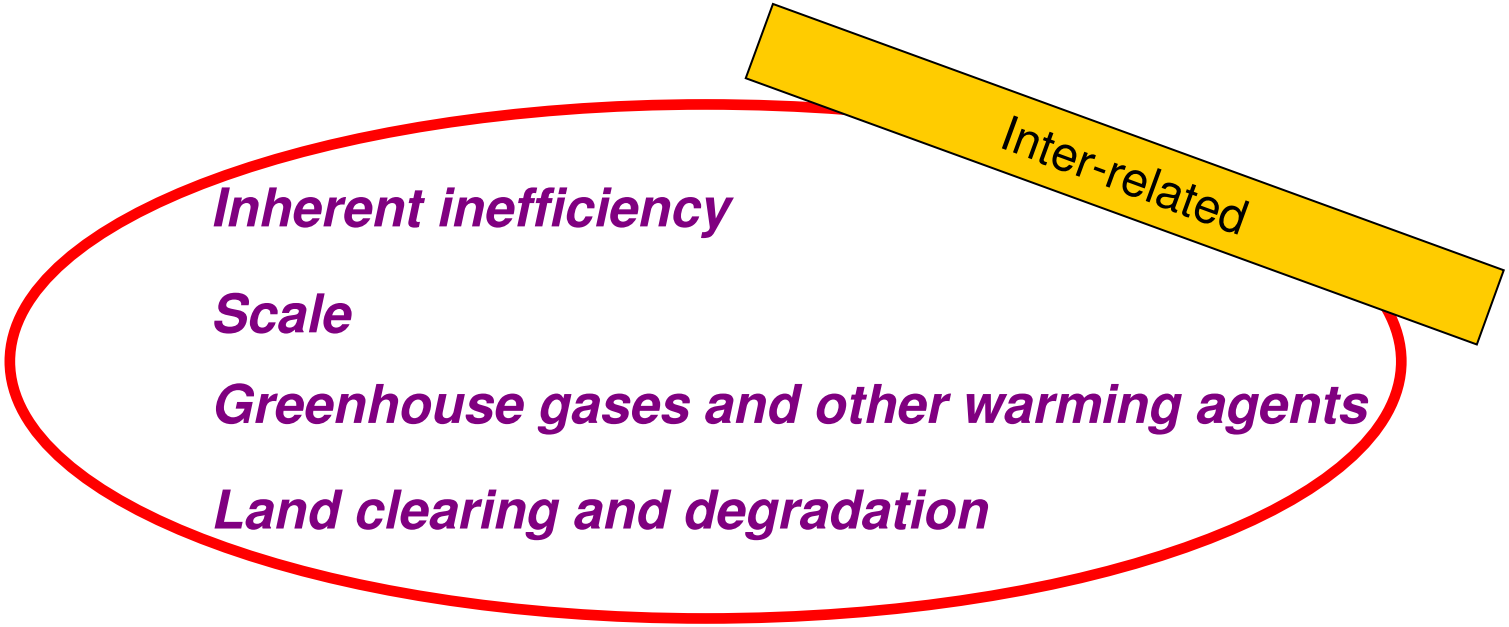
Extreme Weather

Australian Climate Commission: "The Angry Summer", http://pandora.nla.gov.au/pan/136923/20130919-1415/climatecommission.gov.au/report/the-angry-summer/index.html

Livestock



Livestock

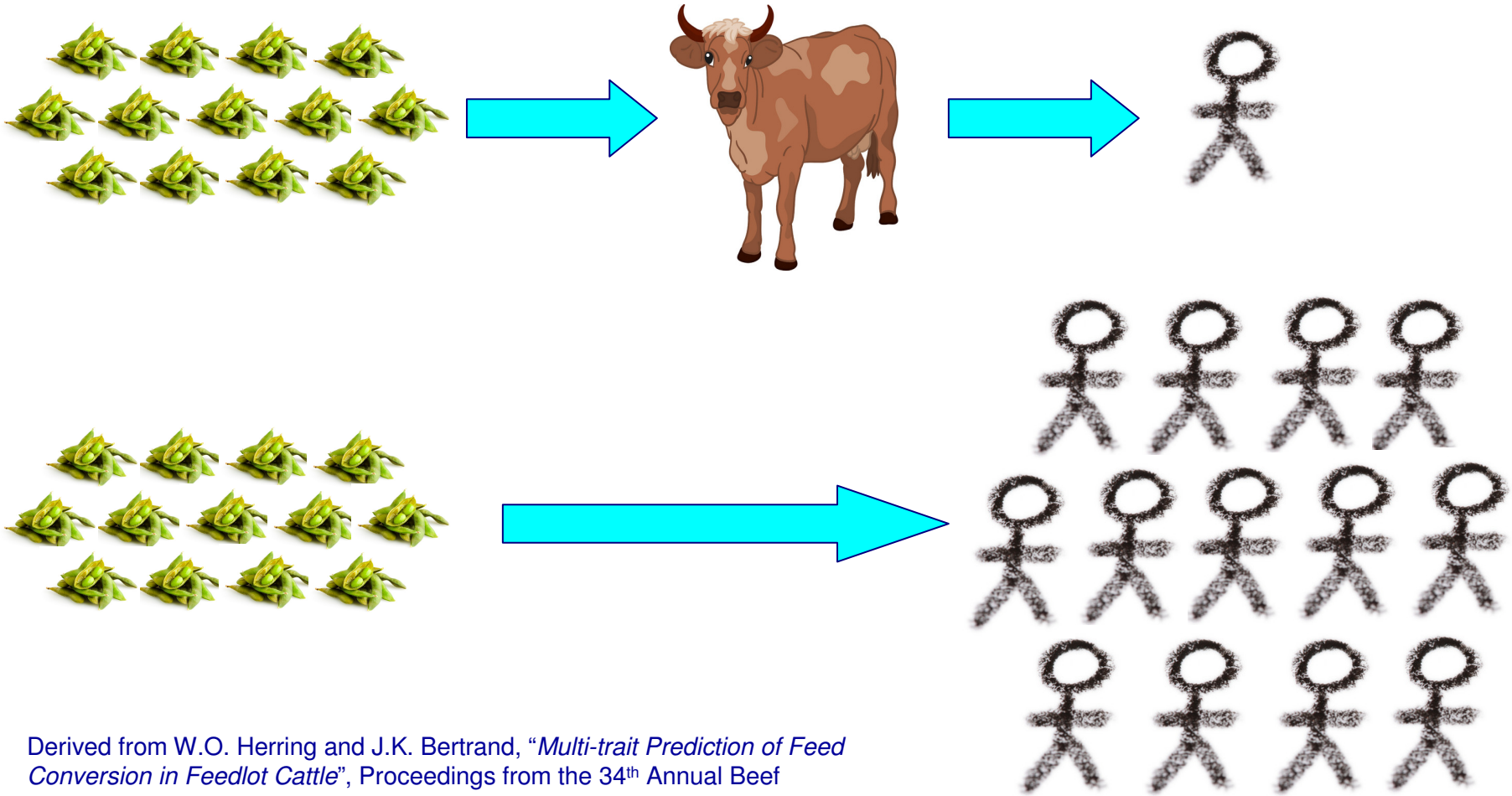
Emissions omitted because relevant factors are:

(a) omitted entirely from official figures, e.g. tropospheric ozone and foregone sequestration

(b) classified under different headings, e.g. livestock-related land clearing reported under "land use, land use change and forestry"

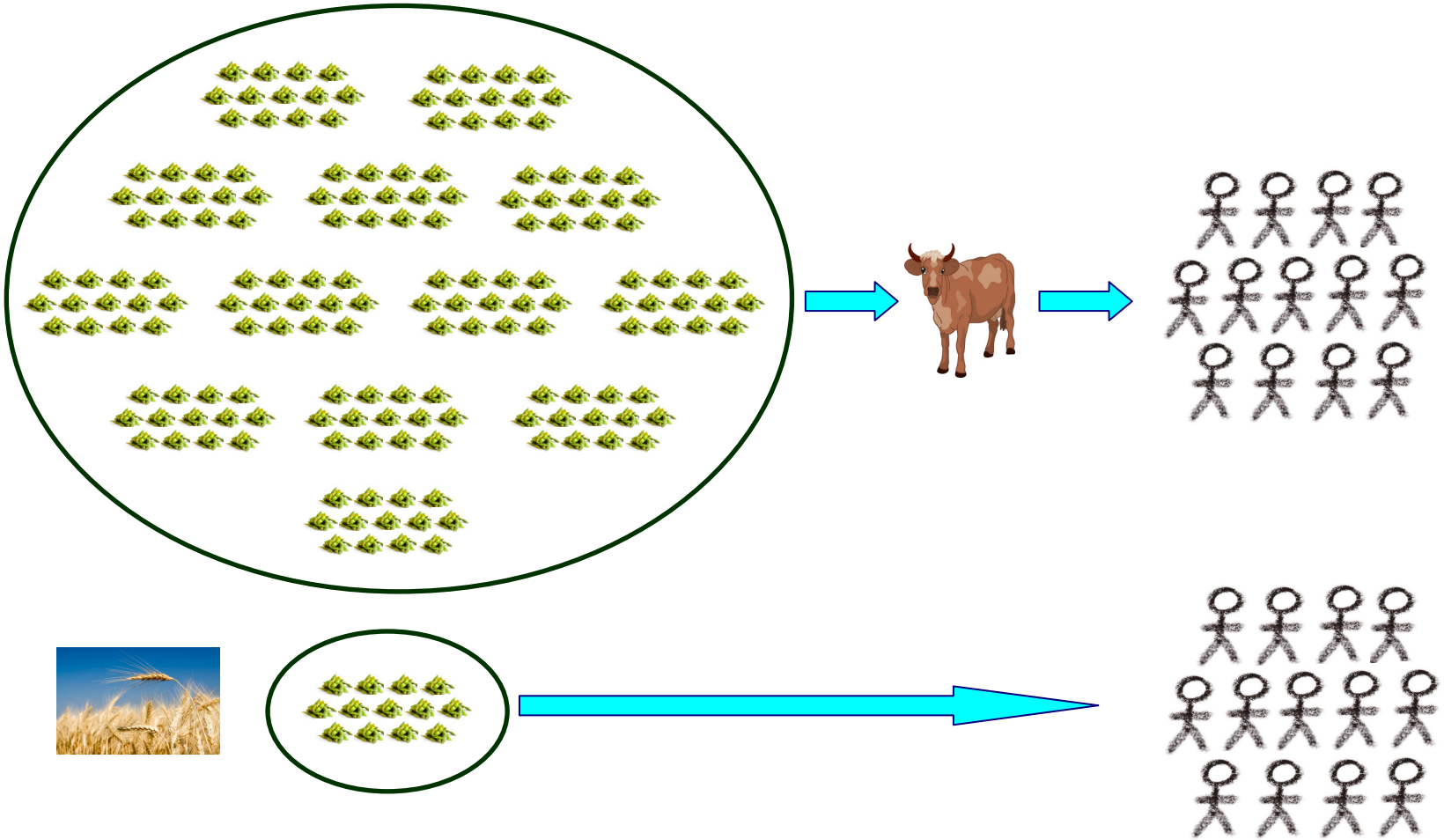
(c) considered but with conservative calculations, e.g. methane's impact based on a 100-year, rather than 20-year, "global warming potential"

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

Inherent inefficiencies



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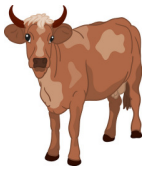
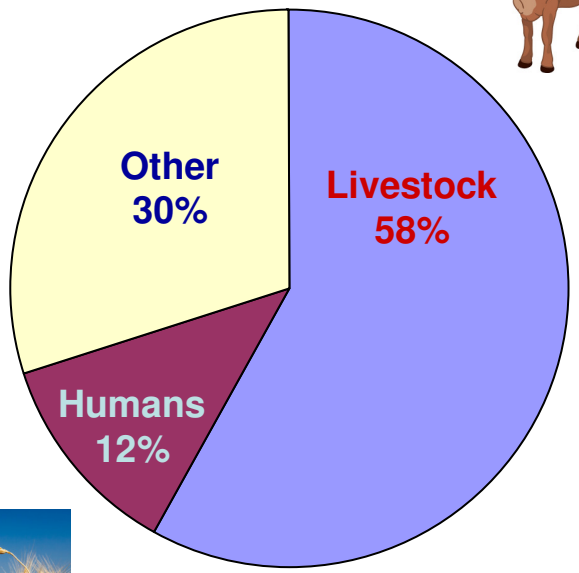
Inherent inefficiencies

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



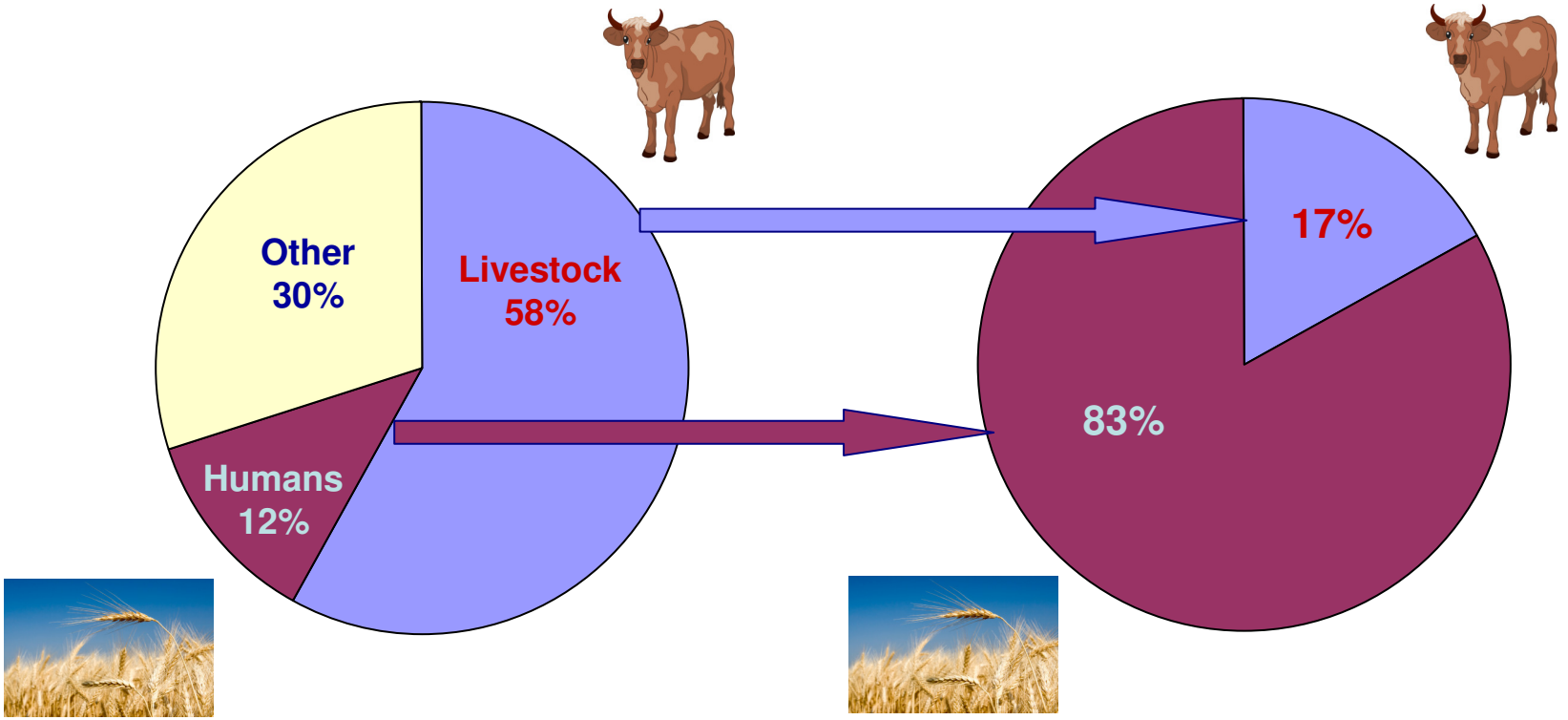


Sources: Derived from Fridolin Krausmann, et al "Global patterns of socioeconomic biomass flows in the year 2000: A comprehensive assessment of supply, consumption and constraints" and Helmut Haberl, et al "Quantifying and mapping the human appropriation of net primary production in earth's terrestrial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

Inherent inefficiencies

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

Humans' calorie intake



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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 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

Inherent inefficiencies

- ***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]

- ***Existing Cropland Could Feed 4 Billion More (incl. US cropland 1 billion more)***

  University of Minnesota, 2013

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

Emily S Cassidy, Paul C West, James S Gerber and Jonathan A Foley, "Redefining agricultural yields: from tonnes to people nourished per hectare", http://iopscience.iop.org/1748-9326/8/3/034015 and http://www1.umn.edu/news/news-releases/2013/UR_CONTENT_451697.html

Scale

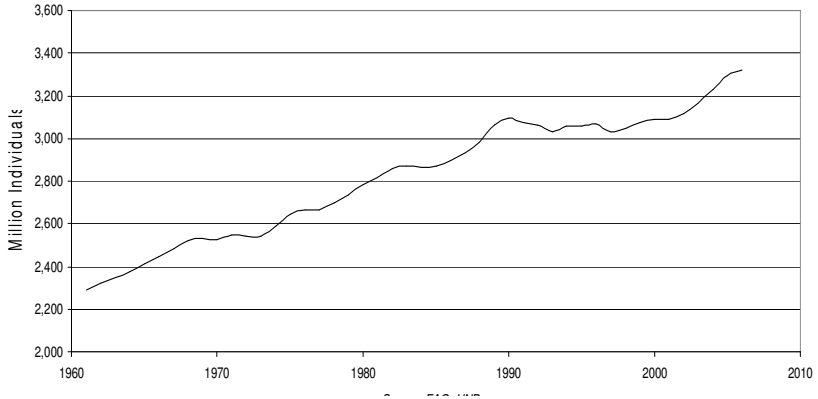
"In the United States, more than 9 billion livestock are maintained to supply the animal protein consumed each year."

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:



Land animals slaughtered 2011: 64 billion approx. incl. over 58 billion chickens globally and 550 million chickens in Australia

- Plus laying hens 6.5 billion
- Plus milk providers 0.7 billion

Livestock biomass 700m tonnes v. human biomass 335m tonnes.

Livestock/wildlife ratio 23:3

Source: Chart - UN FAO cited in Earth Policy Institute book_wote_ch3_13.xls, http://www.earth-policy.org
Slaughter numbers: FAO STAT http://faostat.fao.org/site/569/default.aspx#ancor
Laying hens & milk providers – 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

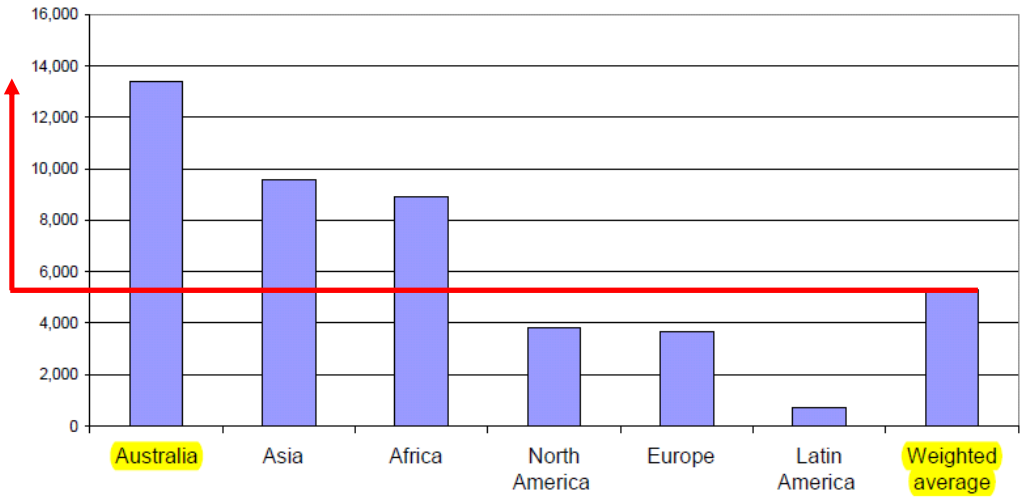
Some context for beef: Aluminium

Based on conservative 100 year GWP

Some context for beef: Aluminium

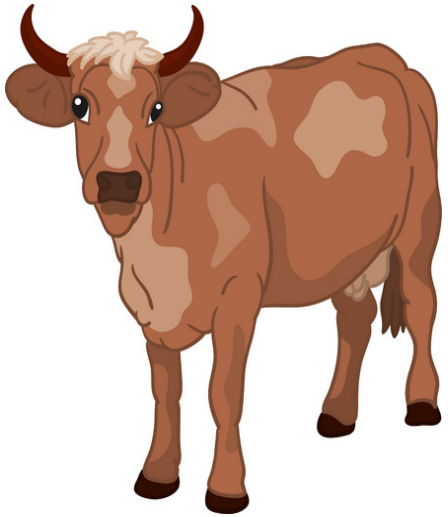
Based on conservative 100 year GWP

- **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.**



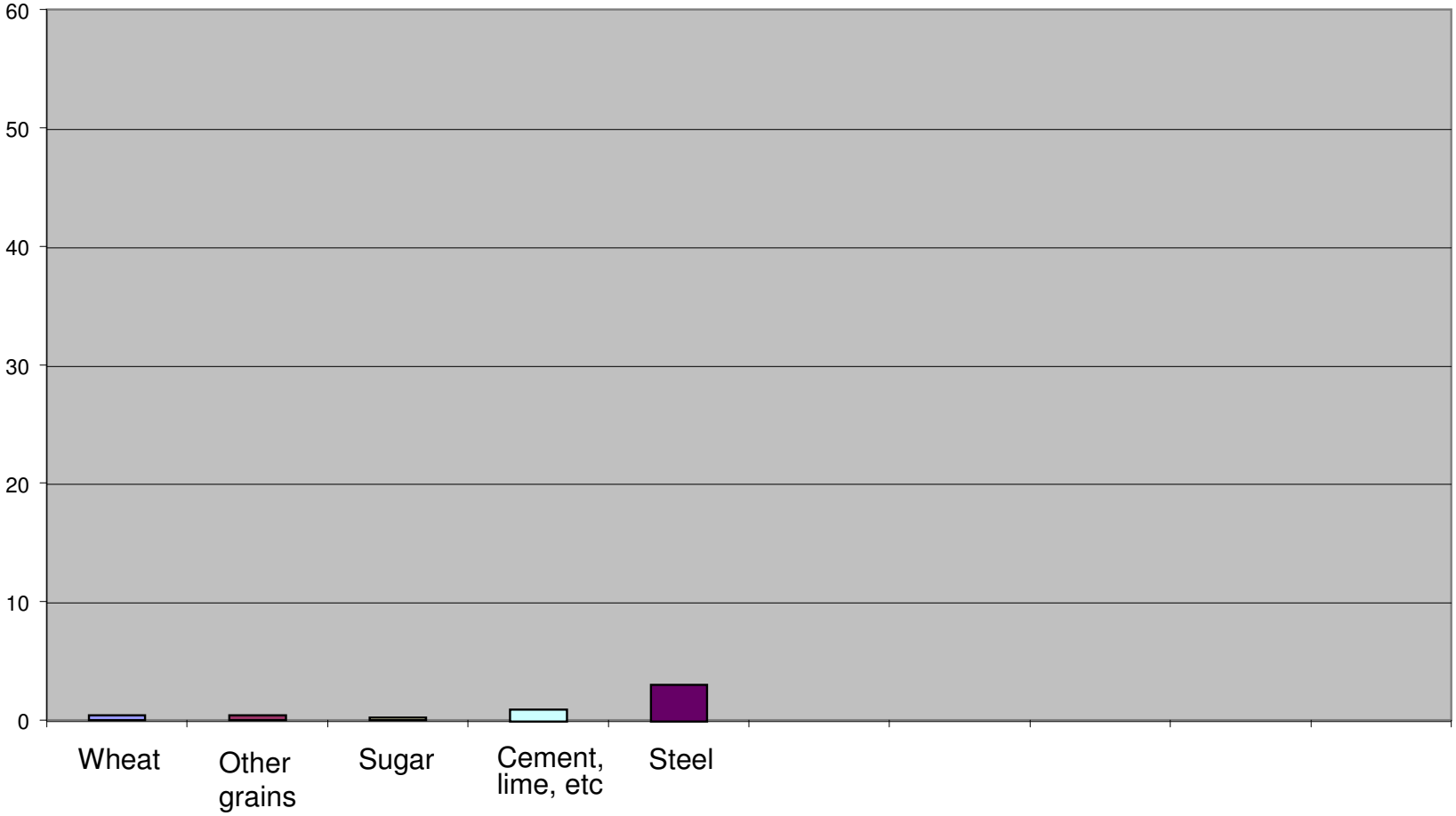
Sources: Hamilton, C, "Scorcher: The Dirty Politics of Climate Change", (2007) Black Inc Agenda, p. 40; Turton, H. "The Aluminium Smelting Industry Structure, market power, subsidies and greenhouse gas emissions", The Australia Institute, Discussion Paper Number 44, January 2002, ISSN 1322-5421, p. ix;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

So how does beef compare?



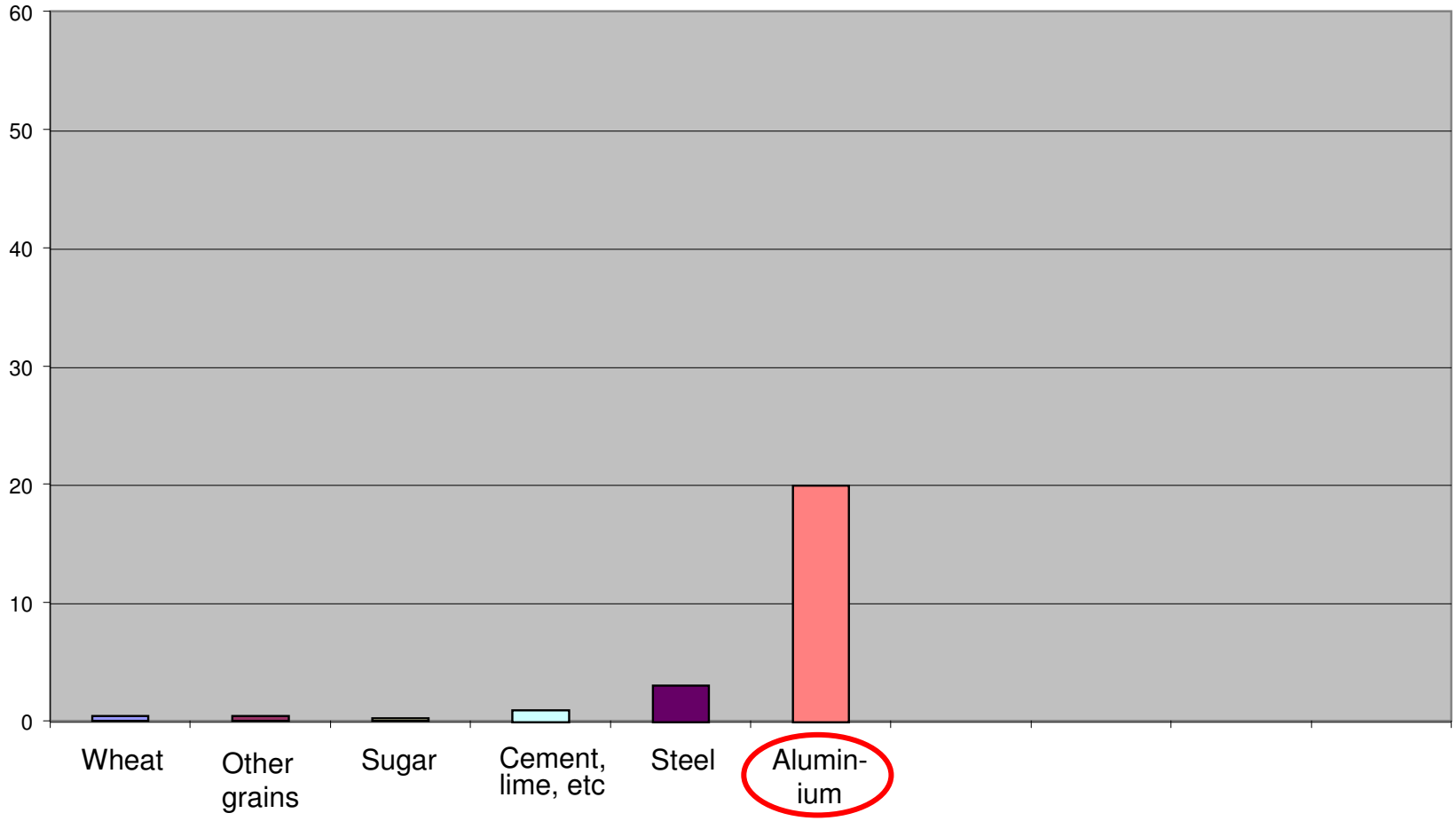
Based on conservative 100 year GWP

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



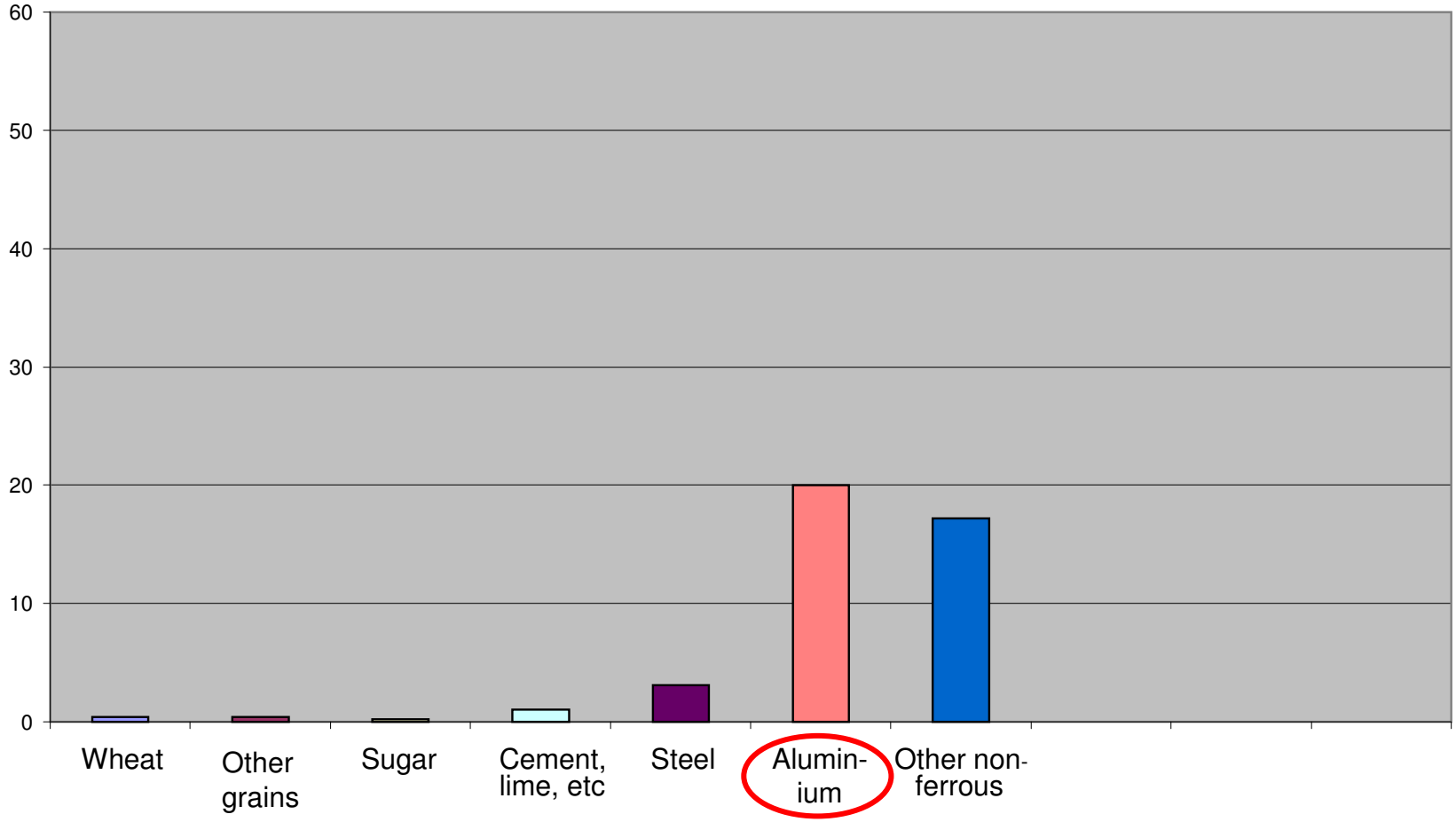
Based on conservative 100 year GWP

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



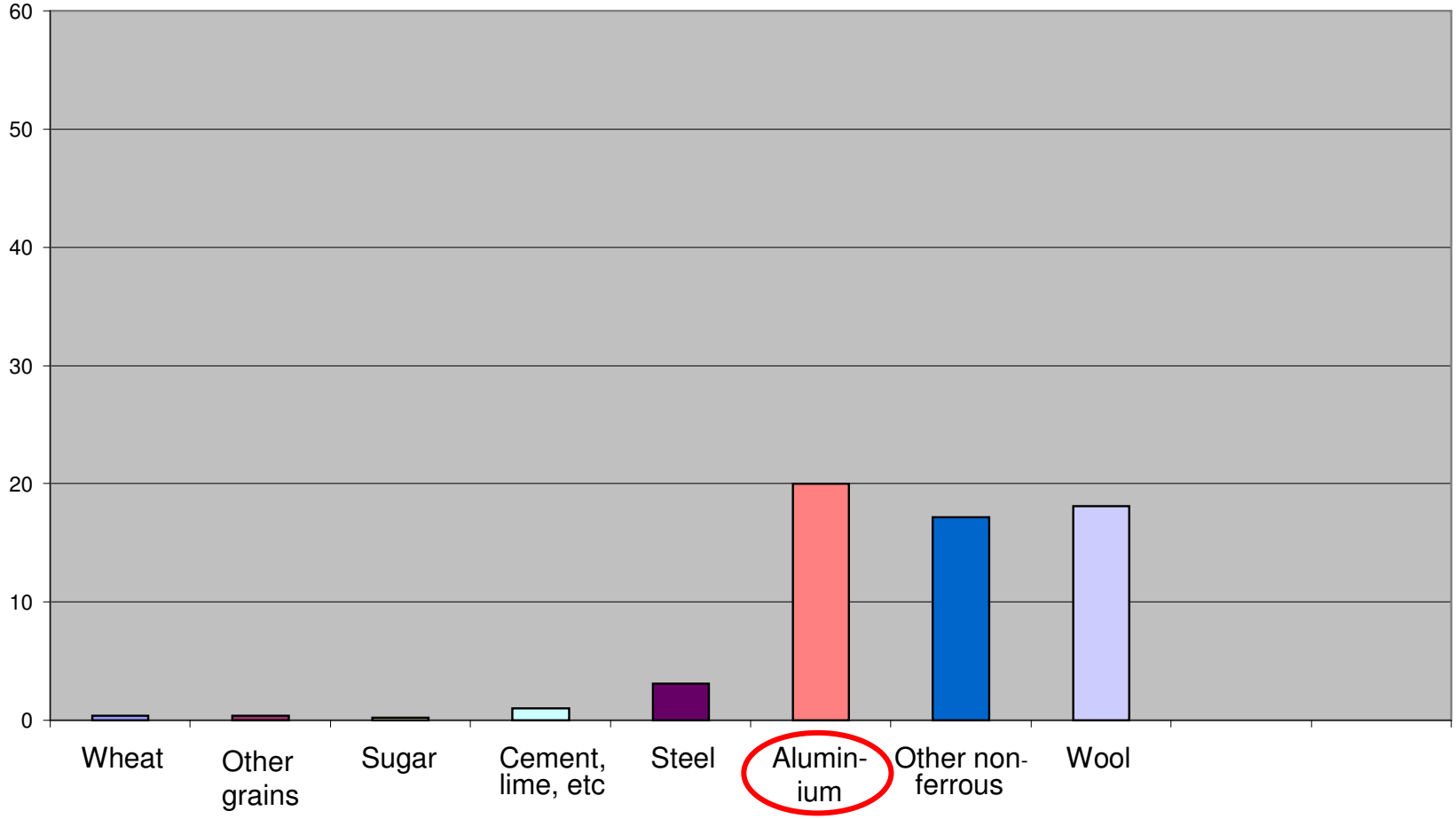
Based on conservative 100 year GWP

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



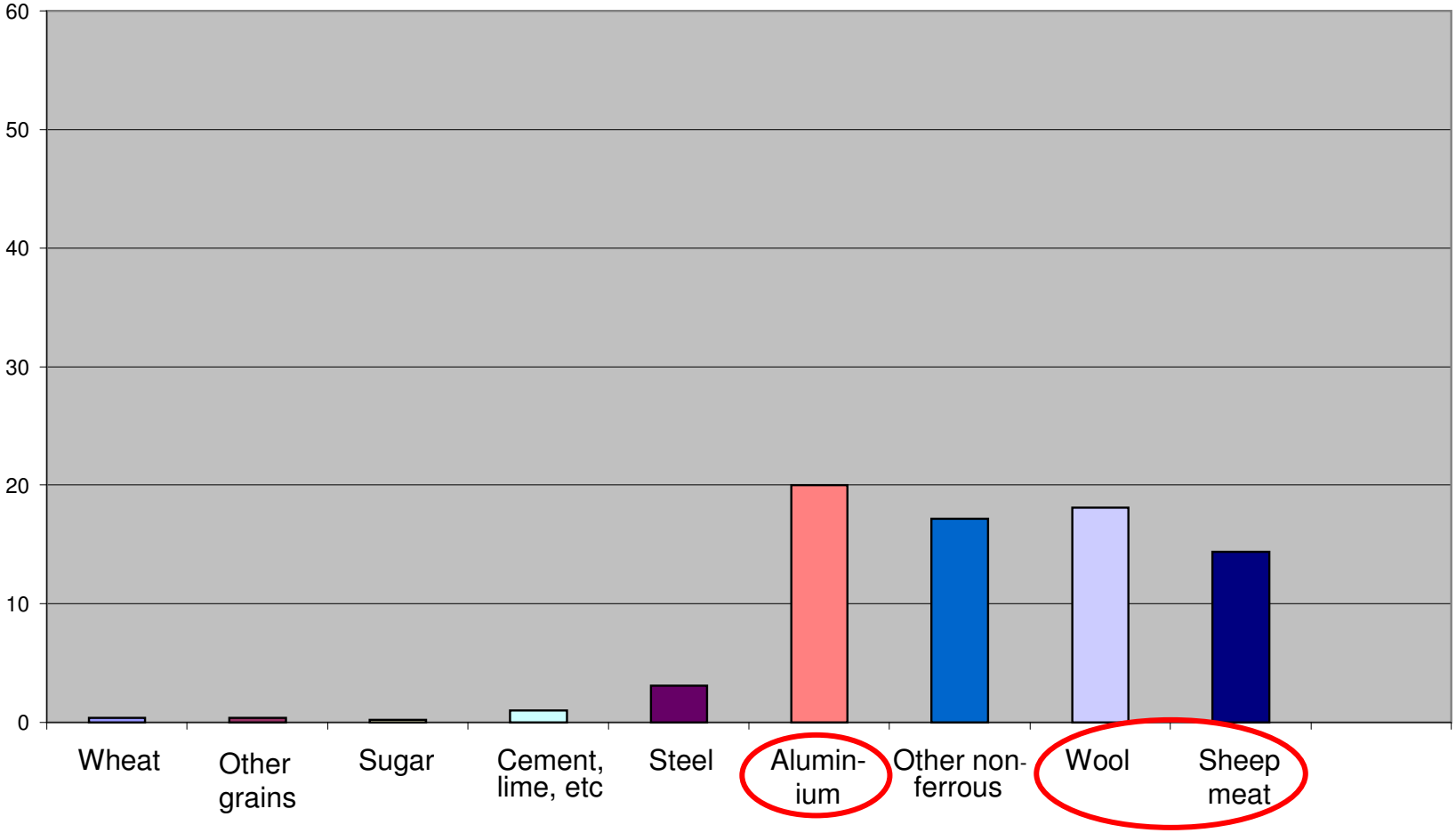
Based on conservative 100 year GWP

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



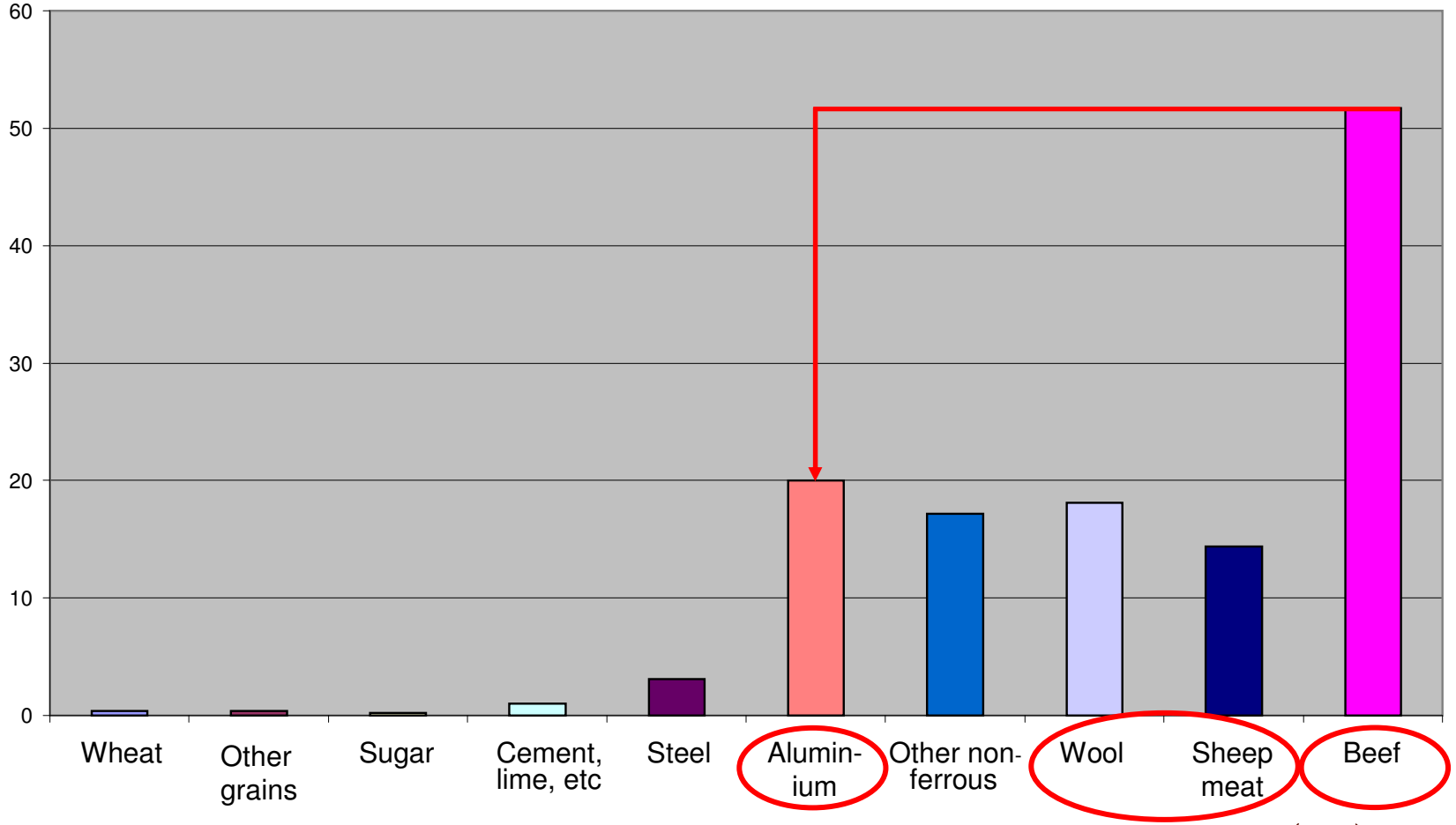
Based on conservative 100 year GWP

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

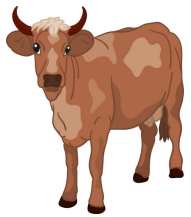


Based on conservative 100 year GWP

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



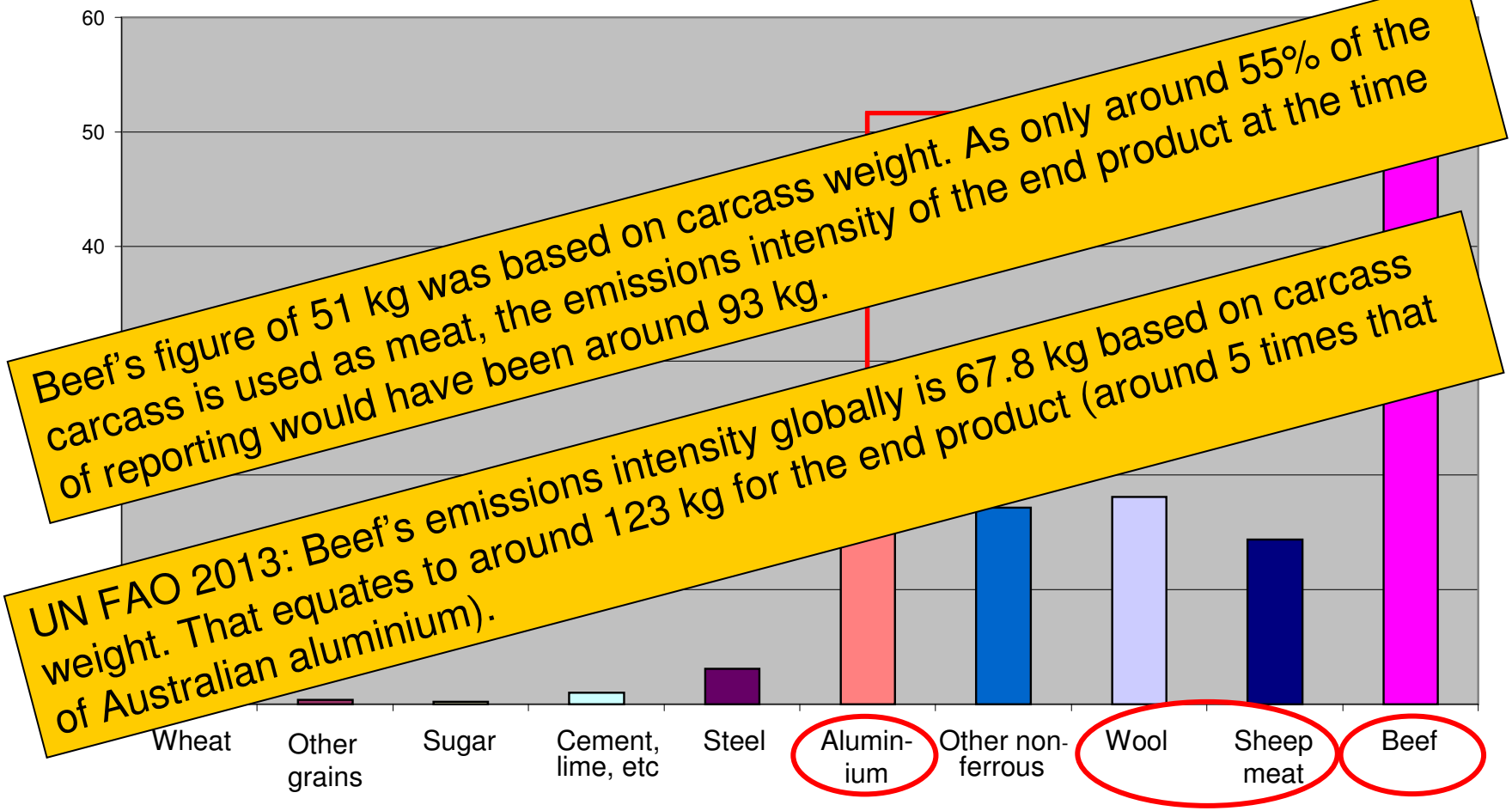
George Wilkenfeld & Associates Pty Ltd and Energy Strategies, National Greenhouse Gas Inventory 1990, 1995, 1999, End Use Allocation of Emissions Report to the Australian Greenhouse Office, 2003, Volume 1, Table S5, p. vii



Paul Mahony 2013

Based on conservative 100 year GWP

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



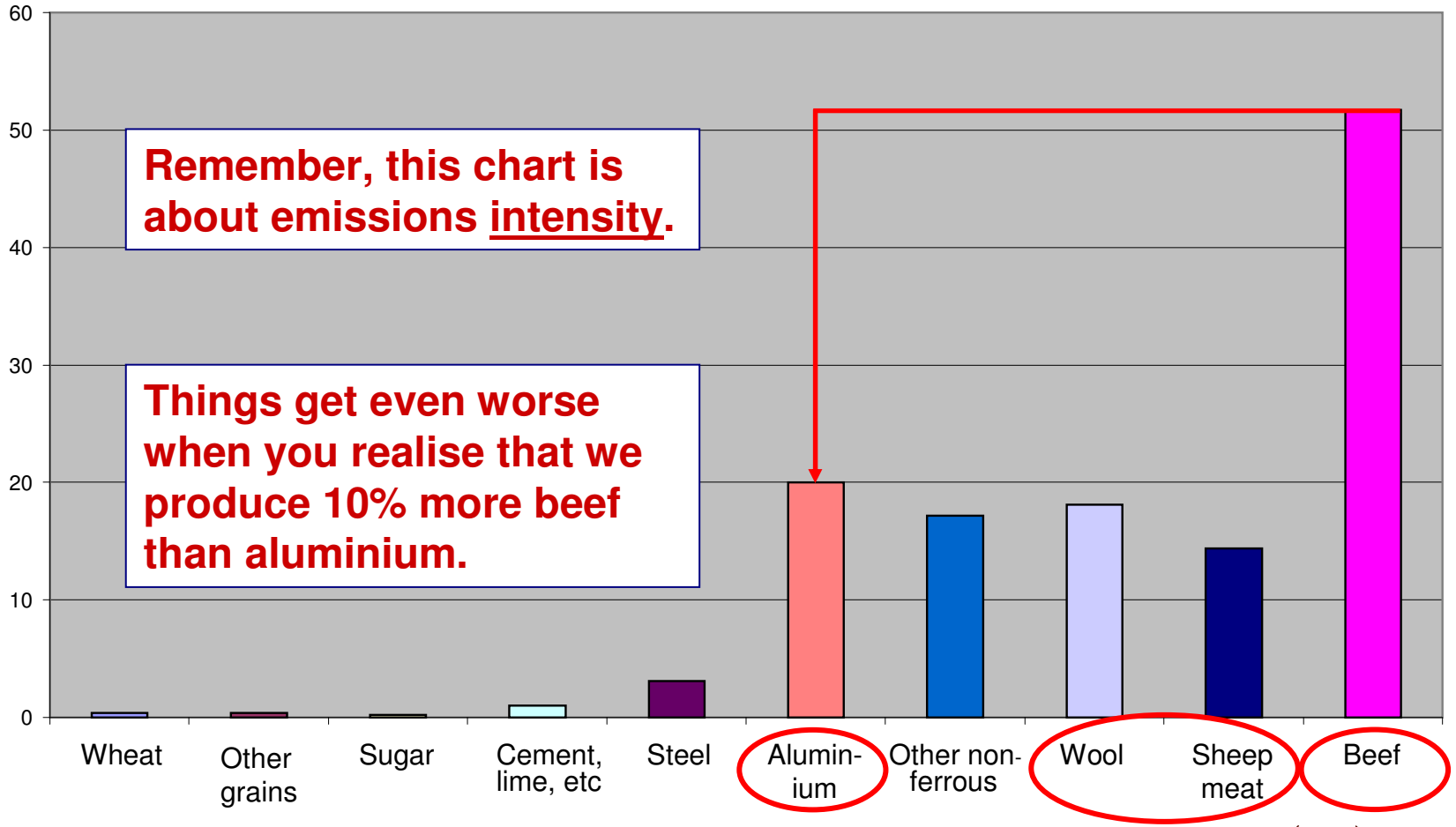
Beef's figure of 51 kg was based on carcass weight. As only around 55% of the carcass is used as meat, the emissions intensity of the end product at the time of reporting would have been around 93 kg.

UN FAO 2013: Beef's emissions intensity globally is 67.8 kg based on carcass weight. That equates to around 123 kg for the end product (around 5 times that of Australian aluminium).

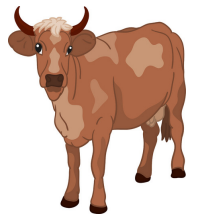
1. George Wilkenfeld & Associates Pty Ltd and Energy Strategies, National Greenhouse Gas Inventory 1990, 1995, 1999, End Use Allocation of Emissions Report to the Australian Greenhouse Office, 2003, Volume 1, Table S5, p. vii
2. Opio, C., Gerber, P., Mottet, A., Falcucci, A., Tempio, G., MacLeod, M., Vellinga, T., Henderson, B. & Steinfeld, H. 2013. Greenhouse gas emissions from ruminant supply chains - A global life cycle assessment. Food and Agriculture Organization of the United Nations (FAO), Rome, http://www.fao.org/docrep/018/i3461e/i3461e.pdf

Based on conservative 100 year GWP

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

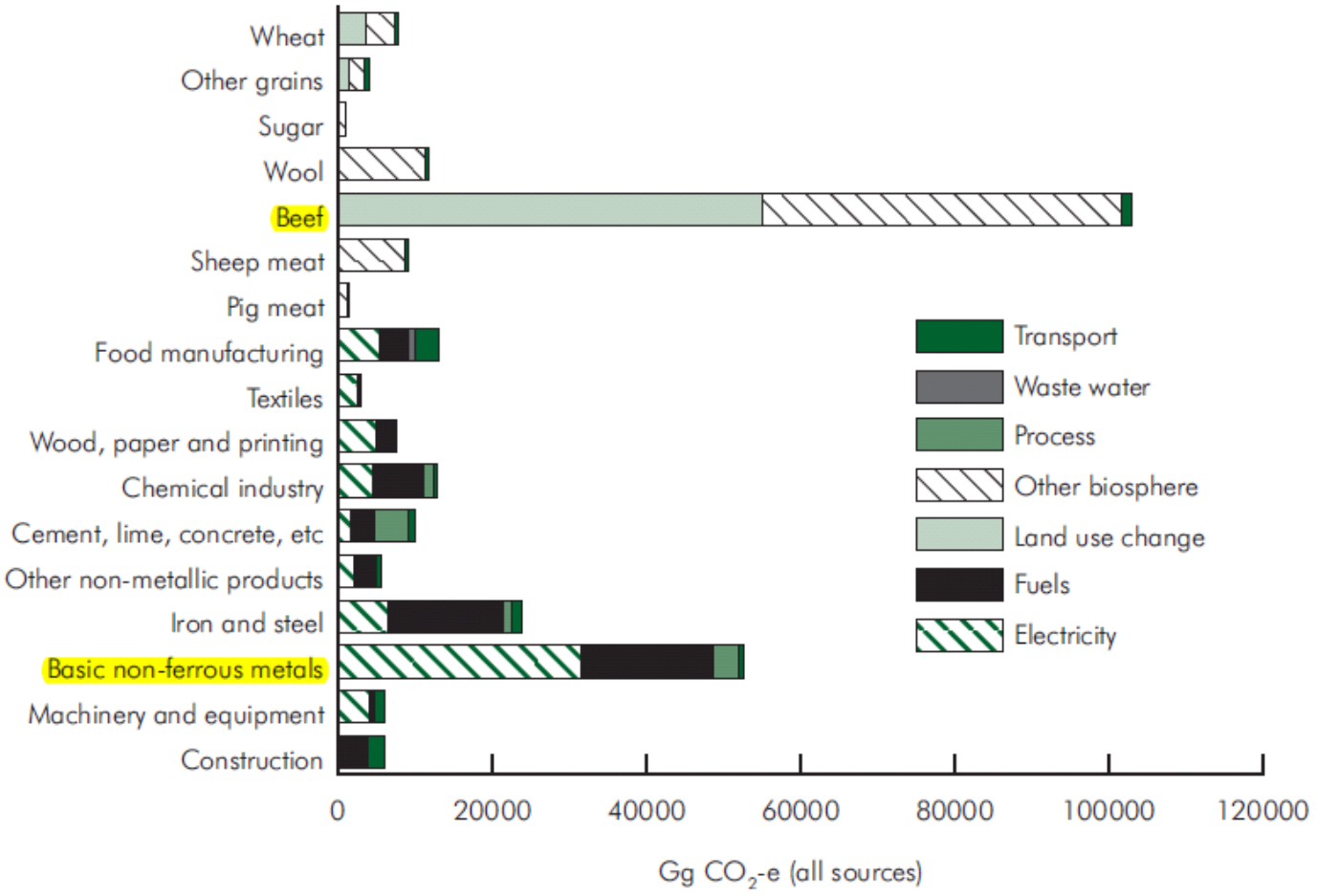


George Wilkenfeld & Associates Pty Ltd and Energy Strategies, National Greenhouse Gas Inventory 1990, 1995, 1999, End Use Allocation of Emissions Report to the Australian Greenhouse Office, 2003, Volume 1, Table S5, p. vii



Based on conservative 100 year GWP

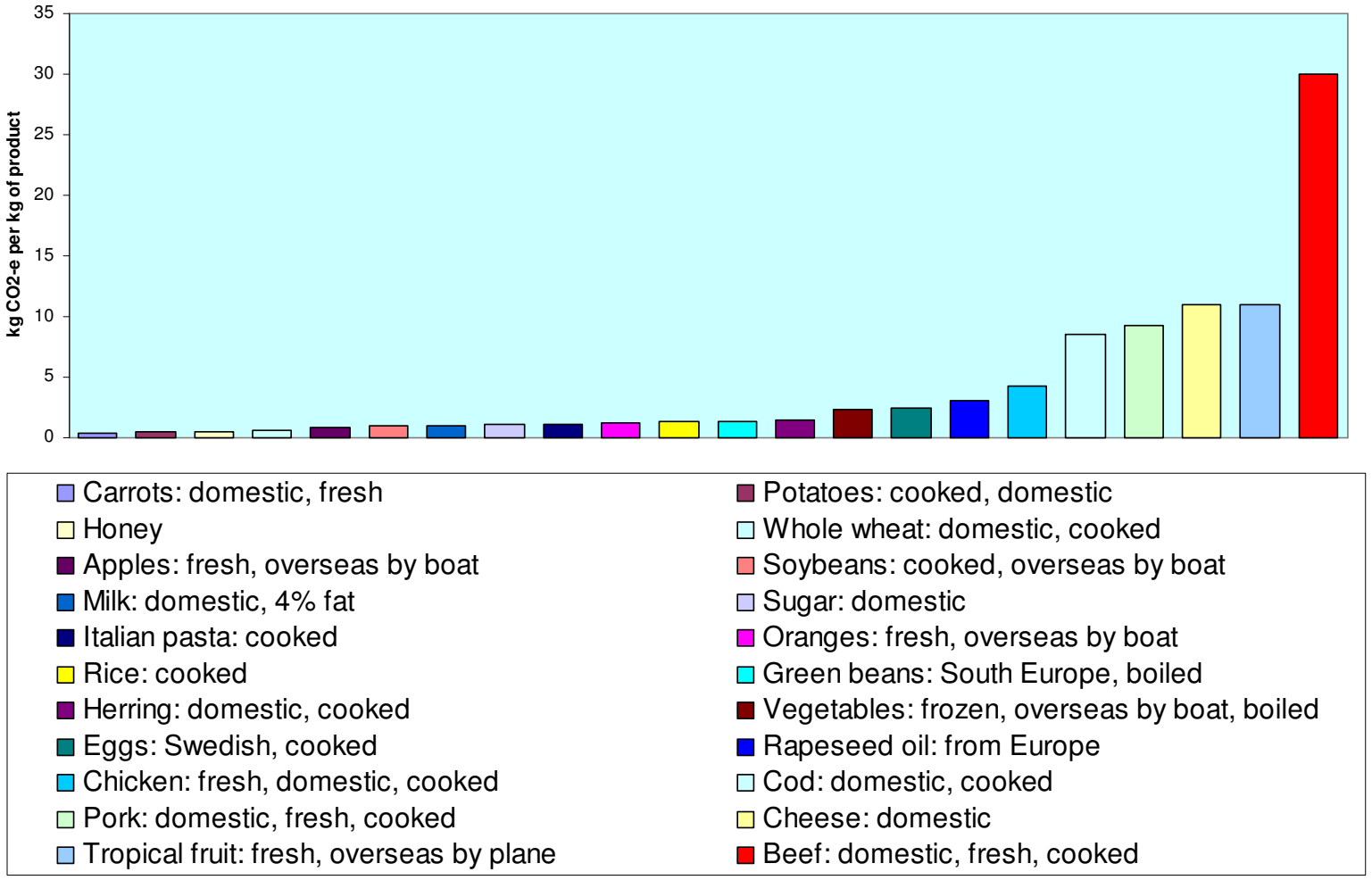
GHG Emissions - Absolute



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

Based on conservative 100 year GWP

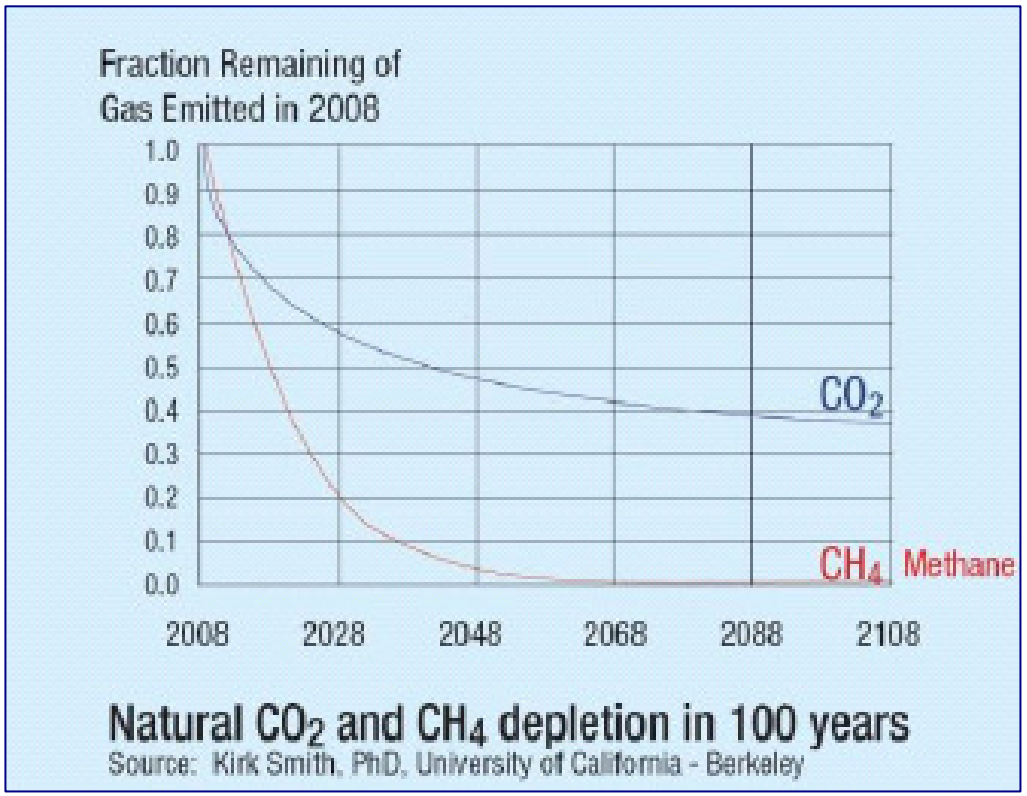
Emissions Intensity: A Swedish Study



Carlsson-Kanyama, A. & Gonzalez, A.D. "Potential Contributions of Food Consumption Patterns to Climate Change", The American Journal of Clinical Nutrition, Vol. 89, No. 5, pp. 1704S-1709S, May 2009, http://www.ajcn.org/cgi/content/abstract/89/5/1704S

CO2-e equivalent (CO2-e) emissions from livestock

20-year "Global Warming Potential" (GWP)



Traditional reporting of methane's global warming potential has understated its shorter-term impact, as it breaks down in the atmosphere much faster than carbon dioxide.

The IPCC's 100-year GWP for methane was 25 in 2007 but has been increased to 34 (with carbon cycle feedbacks) in 2013.

The corresponding figures for a 100 year timeframe are 72 and 86.

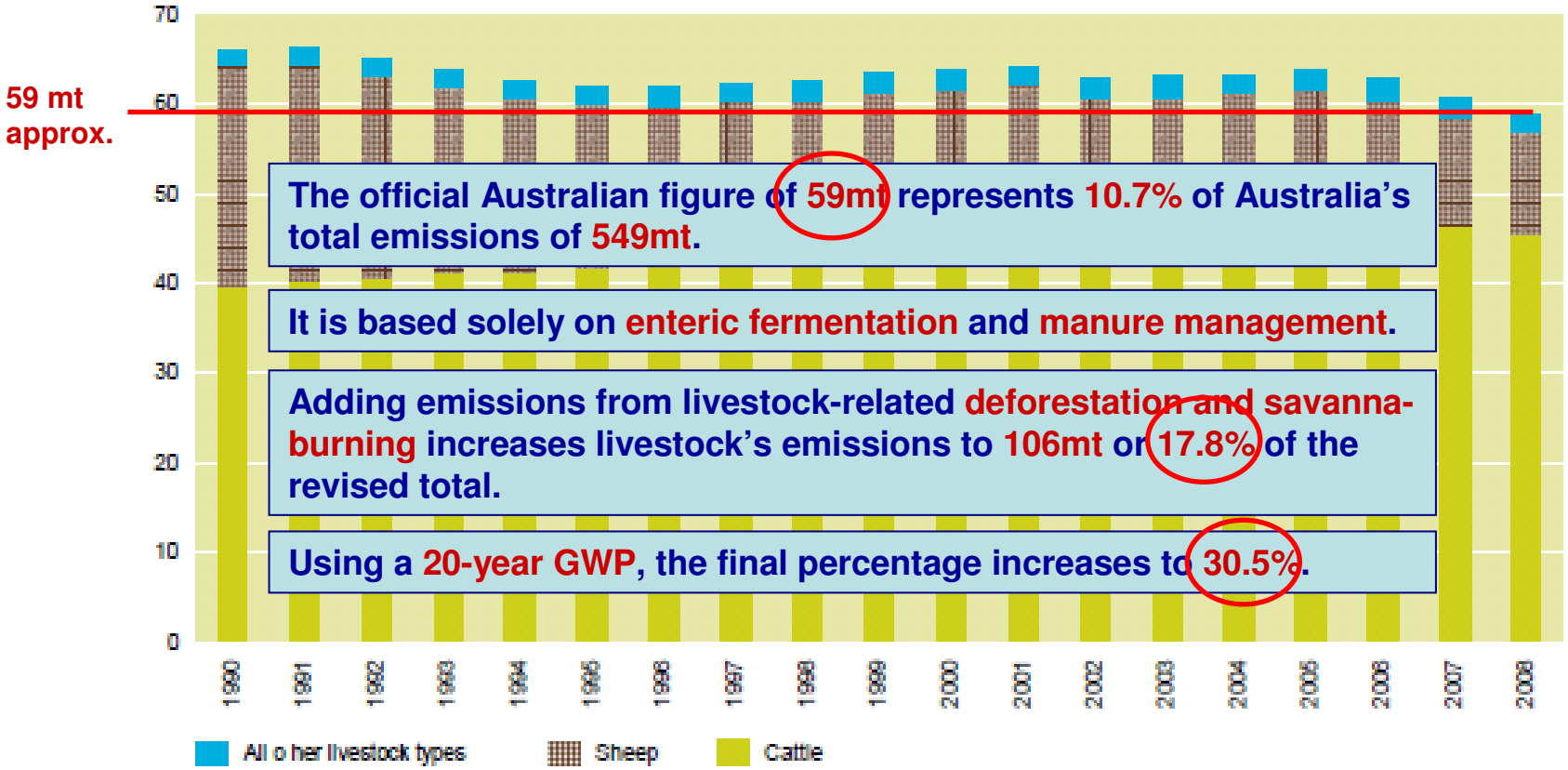
NASA reports figures of 33 for 100 years and 105 for 20 years.

Chart: Smith, K., cited in World Preservation Foundation, *"Reducing Shorter-Lived Climate Forcers through Dietary Change: Our best chance for preserving global food security and protecting nations vulnerable to climate change"*, http://www.worldpreservationfoundation.org/Downloads/ReducingShorterLivedClimateForcersThroughDietaryChange.pdf

Romm, J. *"More Bad News For Fracking: IPCC Warns Methane Traps Much More Heat Than We Thought"*, Climate Progress, 2 Oct 2013, http://thinkprogress.org/climate/2013/10/02/2708911/fracking-ipcc-methane/

Sanderson, K., *"Aerosols make methane more potent"*, Nature, Published online 29 October 2009 | Nature | doi:10.1038/news.2009.1049, http://www.nature.com/news/2009/091029/full/news.2009.1049.html

CO2-e emissions from Australian livestock



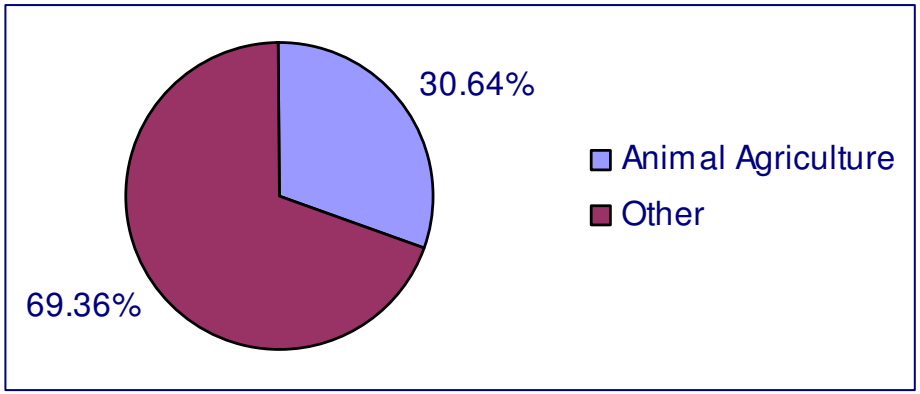
Source:

- 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

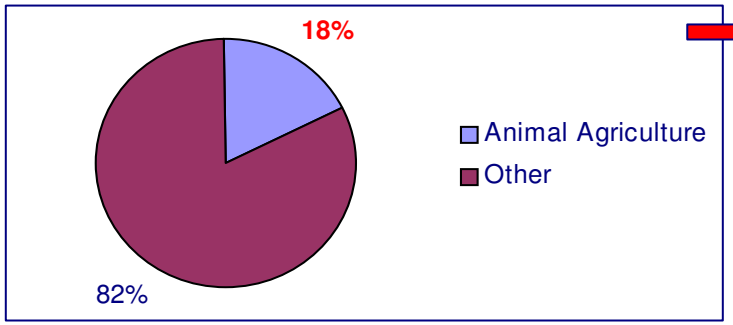
Based on conservative 100 year GWP

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



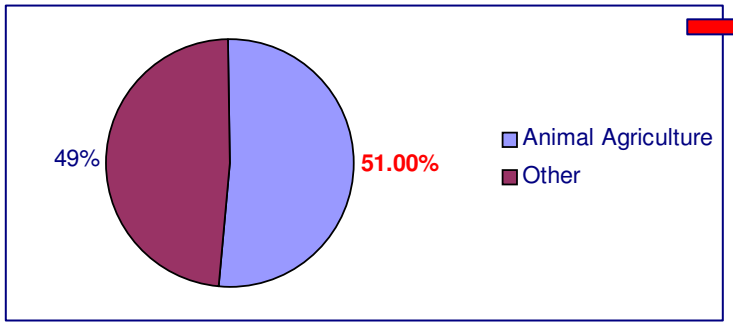
Source: The University of Sydney and CSIRO, 2005, "Balancing Act – A Triple Bottom Line Analysis of the Australian Economy"

CO2-e emissions from livestock globally



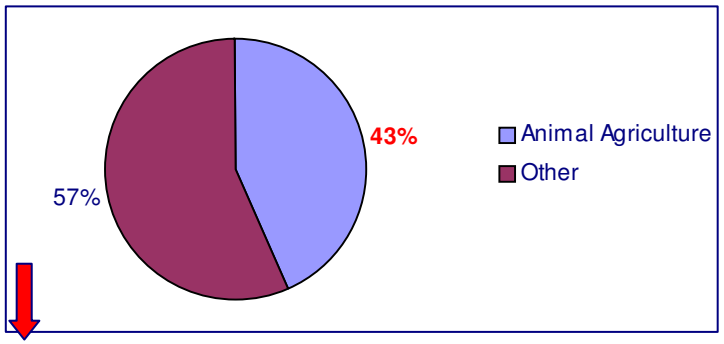
United Nations Food & Agriculture Organization, "Livestock's Long Shadow", 2006

- **Significantly more than all the world's transport**
- **Excludes factors considered by the World Watch Institute (refer below)**
- **Amended to 14.5% in 2013 (See slide 51 of this presentation and full report at http://www.fao.org/docrep/018/i3461e/i3461e.pdf).**



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.***

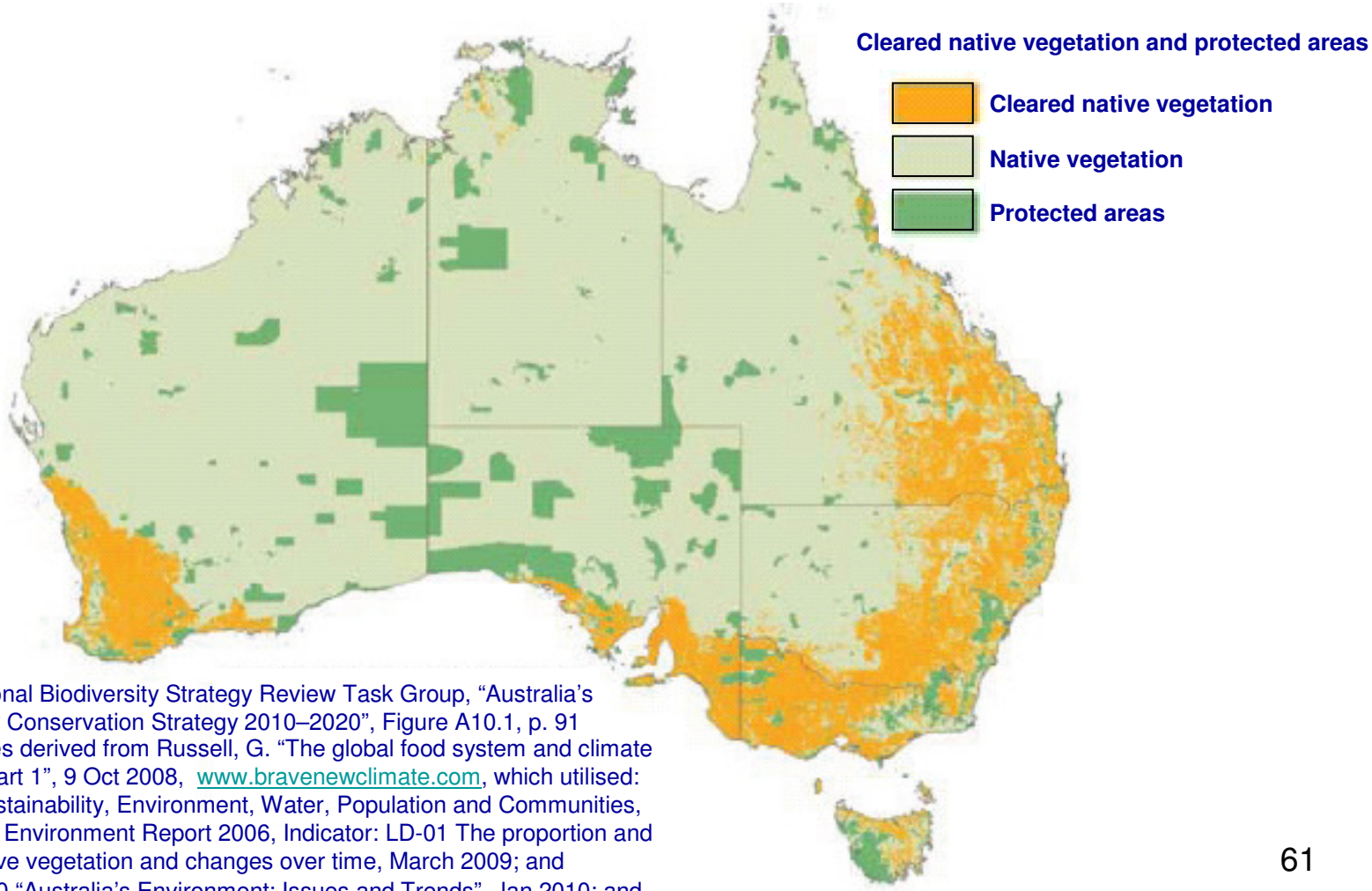
Source of World Watch material: Goodland, R & Anhang, J, *"Livestock and Climate Change - What if the key actors in climate change are cows, pigs, and chickens?"*, World Watch, Nov/Dec, 2009, pp 10-19. (Note: Robert Goodland was formerly lead environmental adviser at the World Bank. Jeff Anhang is a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

Land Clearing

Land Clearing in Australia

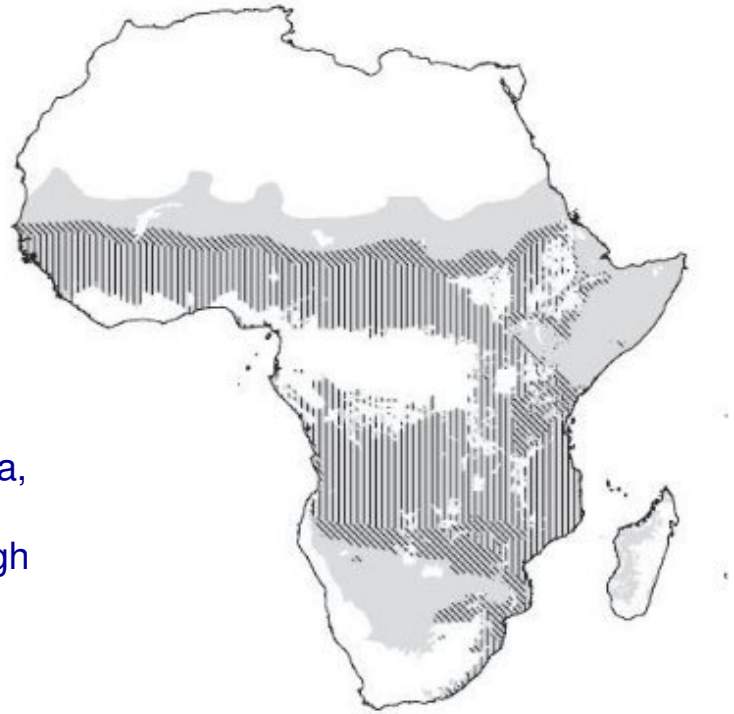
Total area cleared since European settlement approx. 1 million sq. km.

Approx. 70% or 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

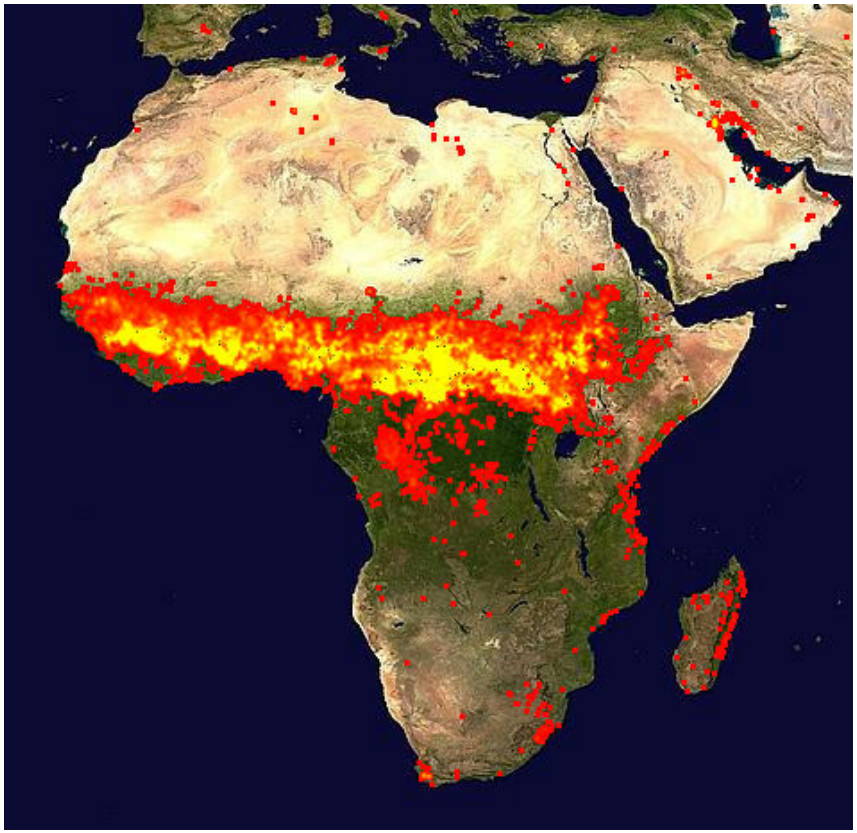
Rainforest destruction in Africa



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.

Sources: Mahesh Sankaran, et al, “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

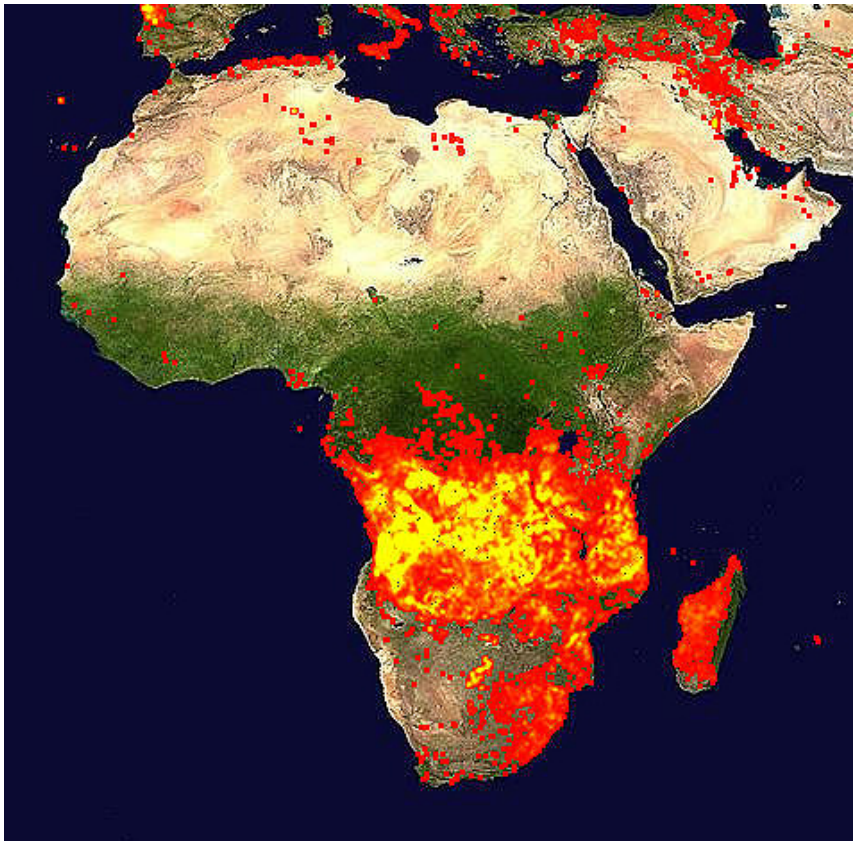
Rainforest destruction in Africa



Sources: Mahesh Sankaran, et al, “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 Africa



Sources: Mahesh Sankaran, et al, “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

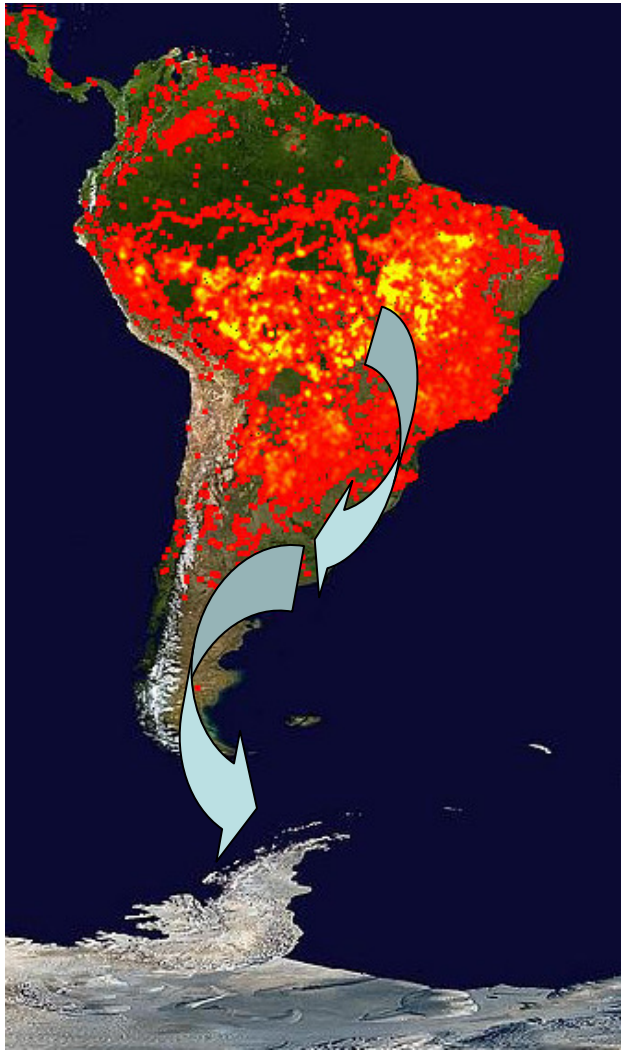
MODIS Rapid Response Team, NASA Goddard Space Flight Center, http://rapidfire.sci.gsfc.nasa.gov/firemaps/

Rainforest destruction in South America

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.



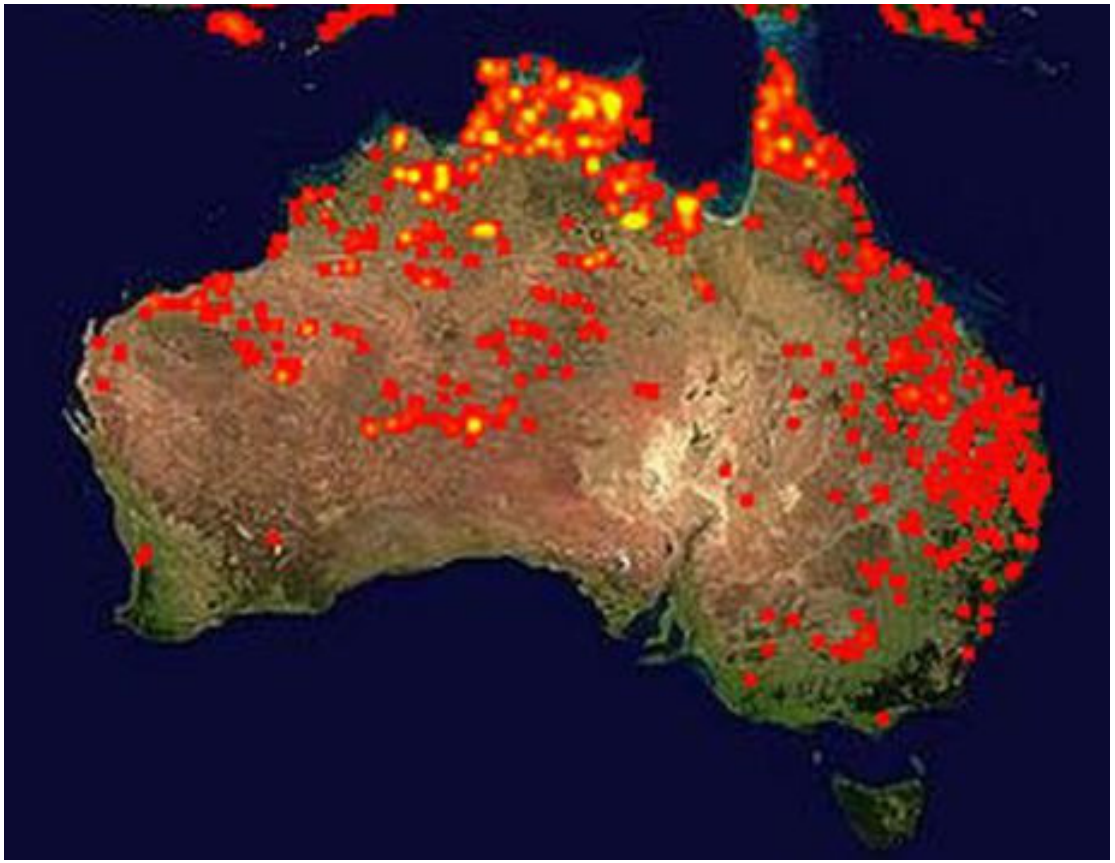
http://www.world-maps.co.uk/continent-map-of-south-america.htm

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

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

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

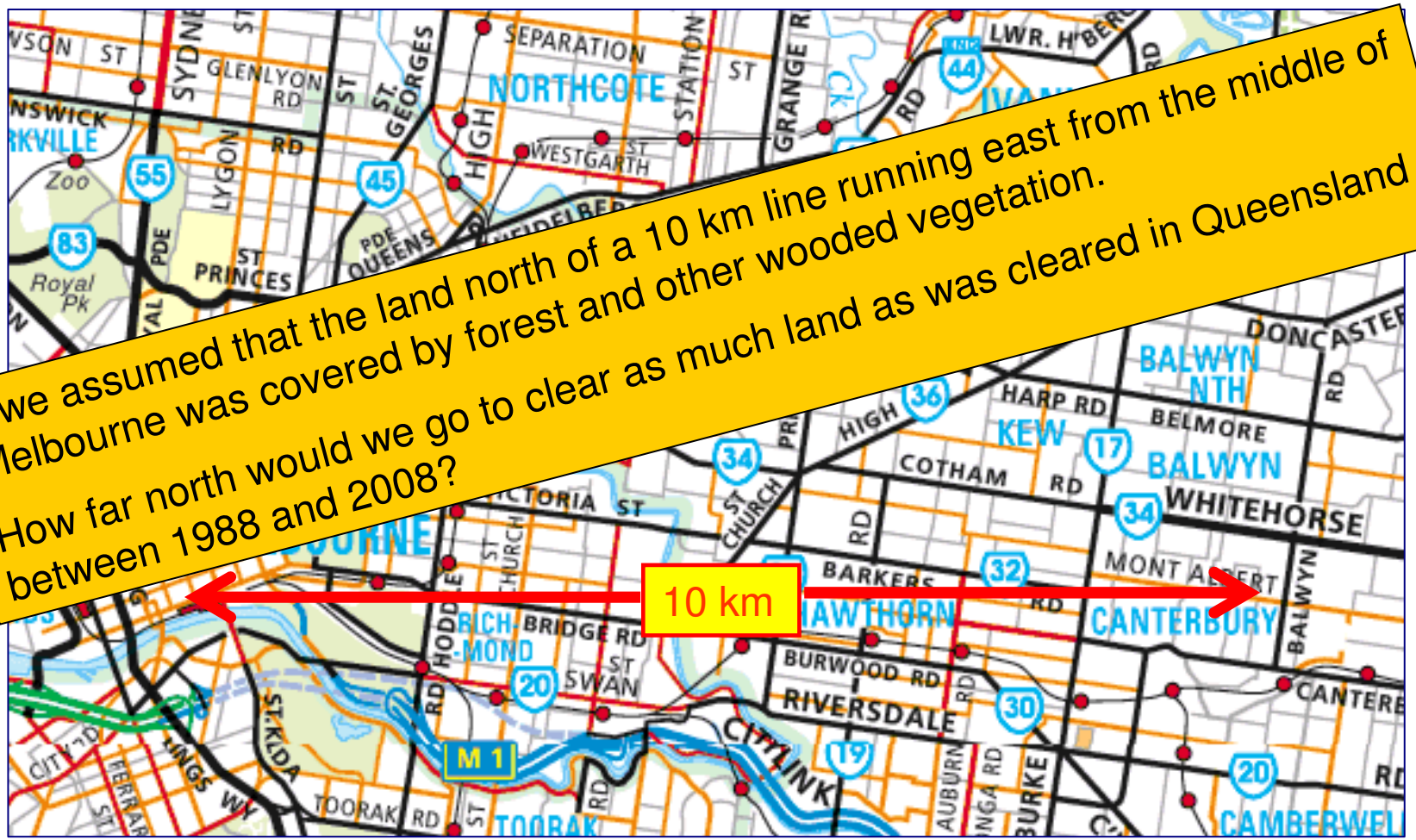
Burning in Australia



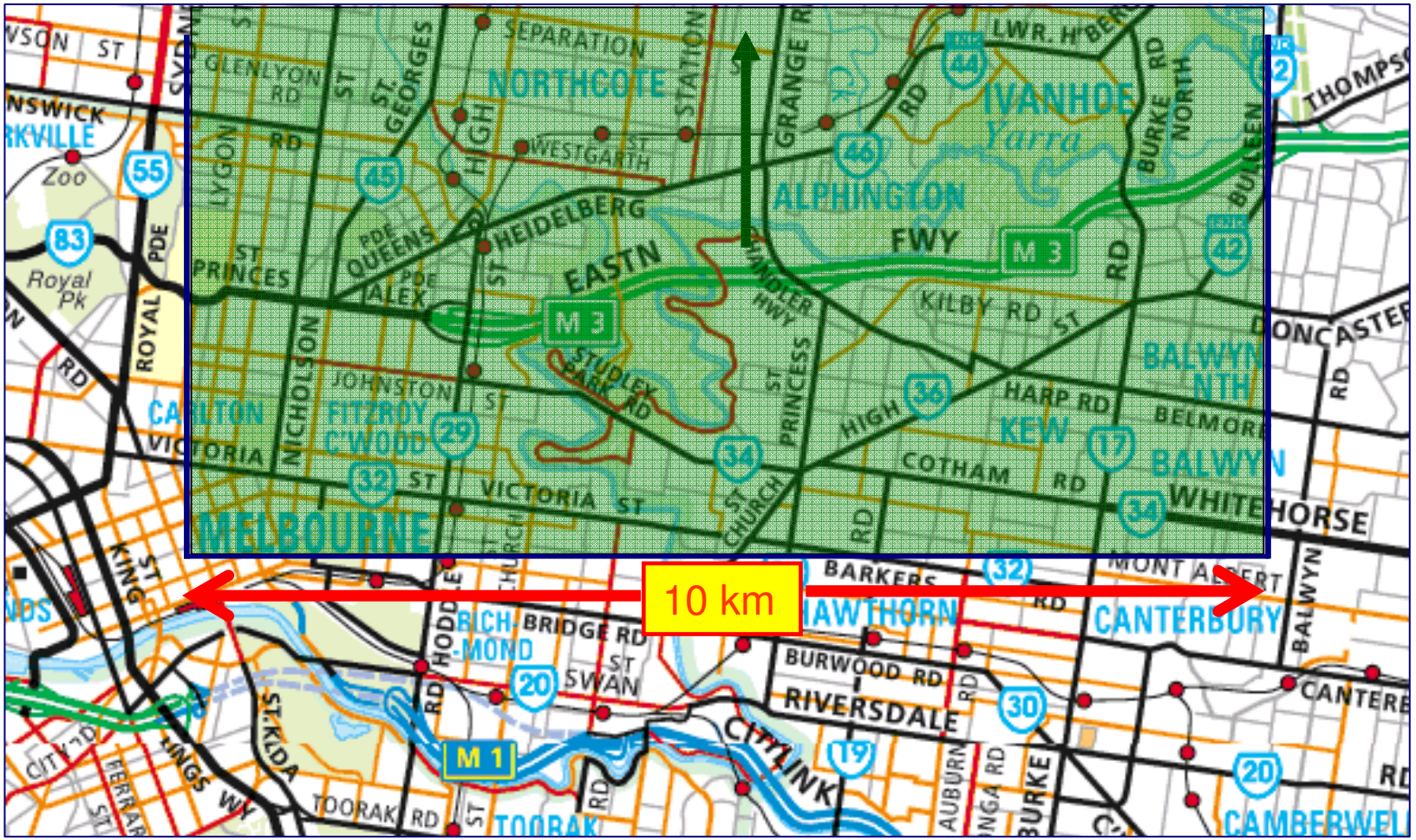
To put Australian savanna burning into context, the 2009 Black Saturday bushfires in the state of Victoria burnt around 4,500 hectares. In comparison, each year in northern Australia where 70% of our cattle graze, we burn 100 times that area across the tropical savanna.

Source: Modis fire map, NASA

Land clearing in Australia

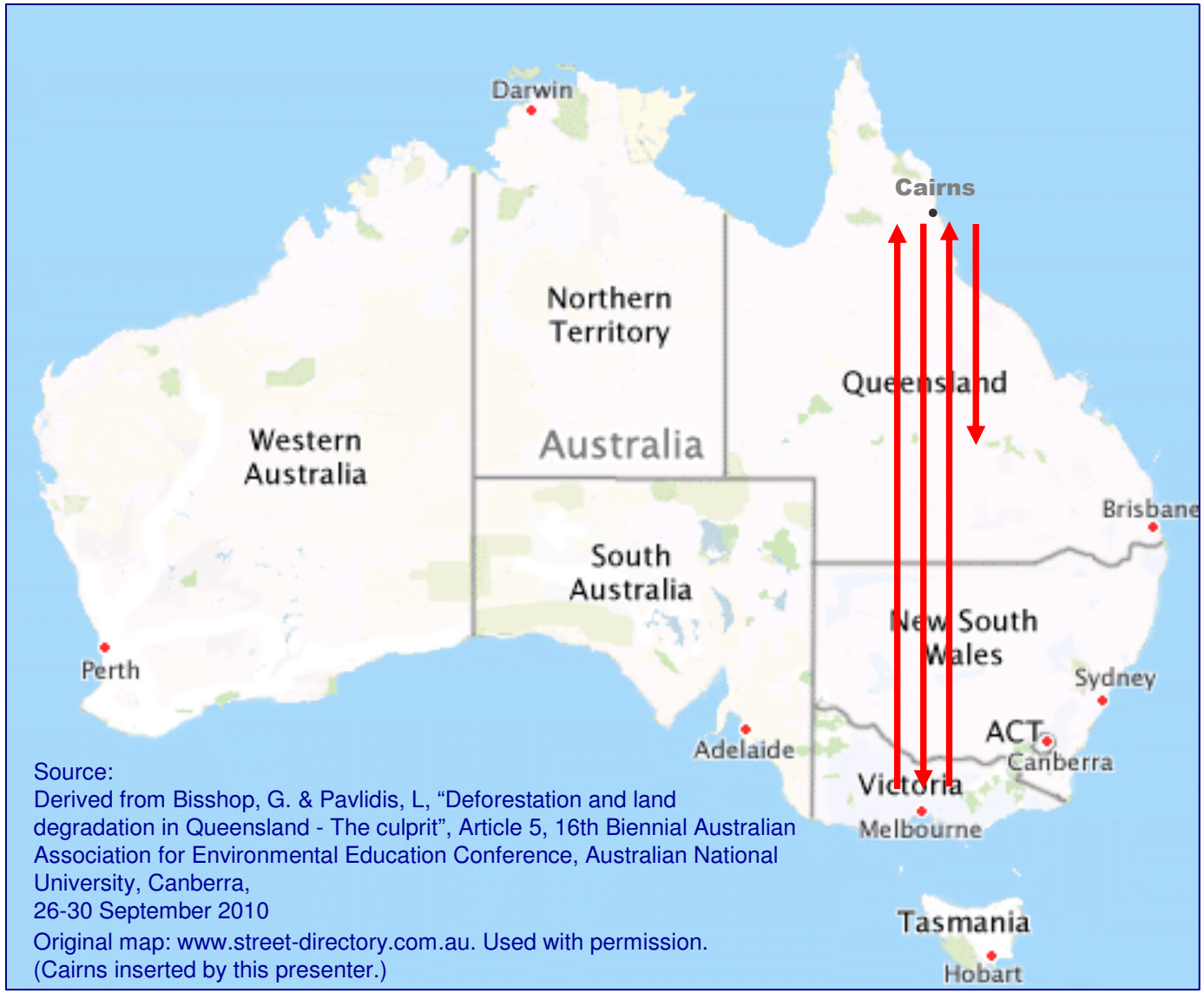


Land clearing in Australia



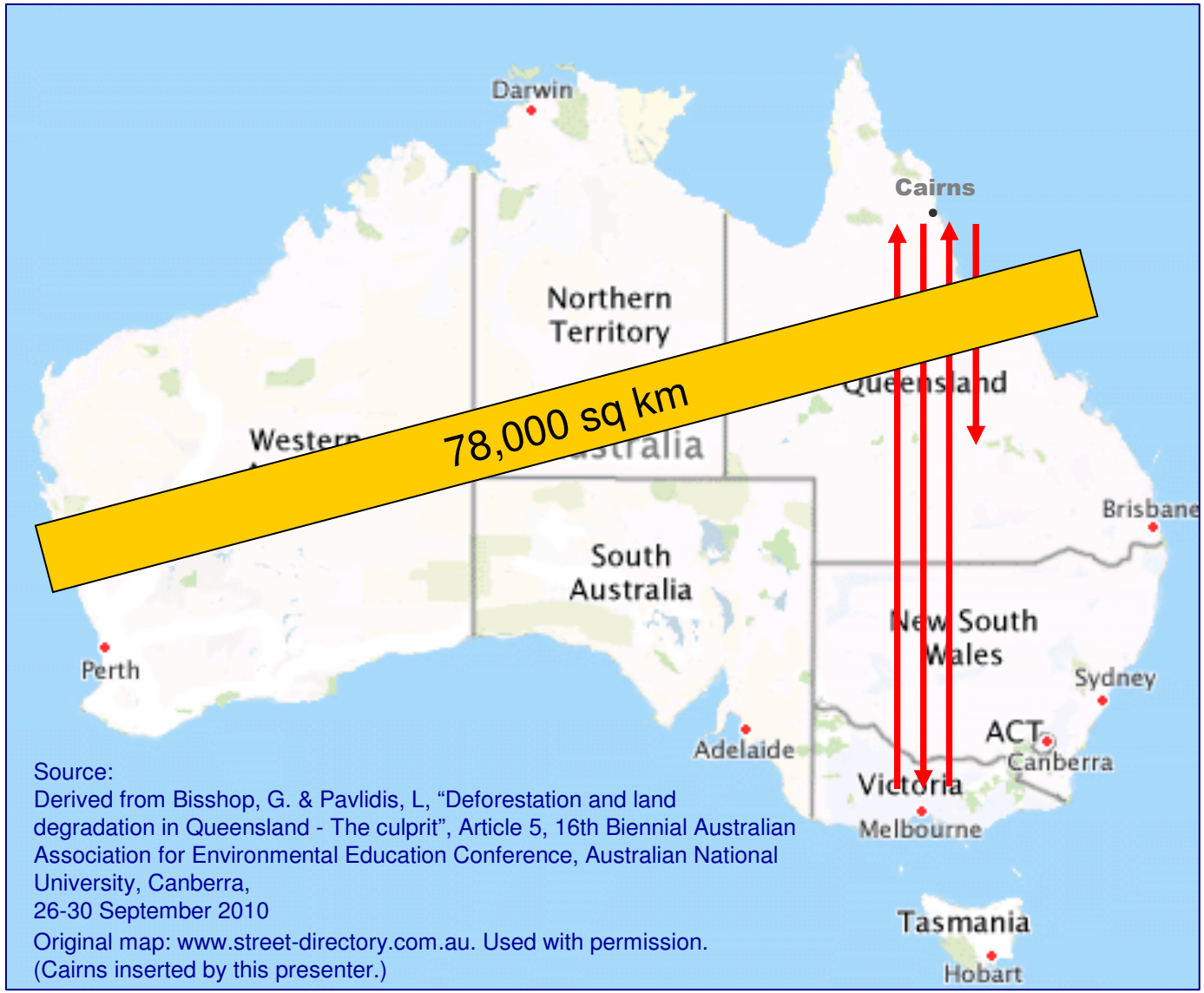
Original Map: Copyright 2010 Melway Publishing Pty Ltd. Reproduced from Melway Edition 38 with permission.

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.)

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.)

Land clearing

UN Food & Agriculture Organization:

"Directly and indirectly, through grazing and through feedcrop production, the livestock sector occupies about 30 percent ice-free terrestrial surface of the planet."

PBL Netherlands Environmental Assessment Agency:

" . . . a global food transition to less meat, or even a complete switch to plant-based protein food [was found] to have a dramatic effect on land use. Up to 2,700 Mha of pasture and 100 Mha of cropland could be abandoned, resulting in a large carbon uptake from regrowing vegetation. Additionally, methane and nitrous oxide emissions would be reduced substantially." A plant-based diet would reduce climate change mitigation costs by **80%**. A meat-free diet would reduce them by **70%**.

Zero Carbon Britain:

"ZCB 2030 will revolutionise our landscape and diets. An 80% reduction in meat and dairy production will free up land to grow our own food and fuel whilst also sequestering carbon from the atmosphere."

Steinfeld, H. et al. 2006, "Livestock's Long Shadow: Environmental Issues and Options. Livestock, Environment and Development", FAO, Rome, p. 4.

Elke Stehfest, Lex Bouwman, Detlef P. van Vuuren, Michel G. J. den Elzen, Bas Eickhout and Pavel Kabat, "Climate benefits of changing diet" Climatic Change, Volume 95, Numbers 1-2 (2009), 83-102, DOI: 10.1007/s10584-008-9534-6 (Also http://www.springerlink.com/content/053gx71816jq2648/)

Centre for Alternative Technology, Wales, "Zero Carbon Britain", 2010, http://www.zerocarbonbritain.com/ and http://www.zerocarbonbritain.com/resources/factsheets

Bill McKibben 350.org

McKibben's position does not stand up to close scrutiny, and can be paraphrased as:

"If we want to reduce emissions from animal agriculture, we need to move away from factory farming, adopt a modified form of grazing, and buy locally."

See *"Do the math: there are too many cows"*
http://terrastendo.net/2013/07/26/do-the-math-there-are-too-many-cows/ and
"Livestock and climate: Why Alan Savory is not a saviour"
http://terrastendo.net/2013/03/26/livestock-and-climate-why-allan-savory-is-not-a-saviour/

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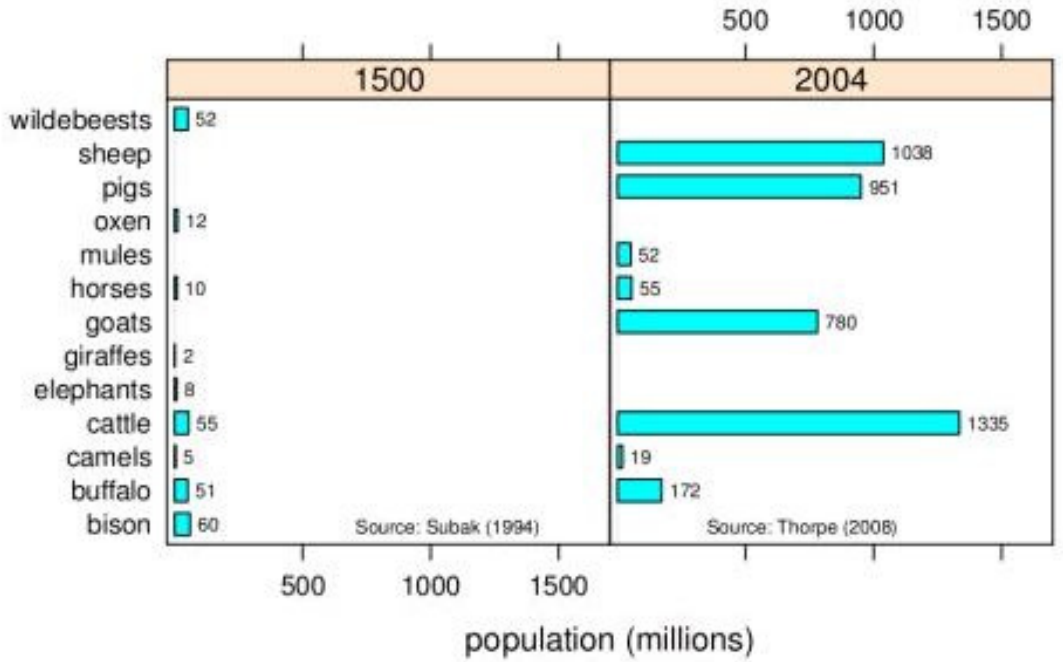
Livestock population

McKibben's suggestion that there were "big herds of big animals" before European settlement is difficult to reconcile with the fact that the native pronghorn (the USA's "antelope") generally weigh around one-tenth as much as cows and bulls bred for beef. Even allowing for bison, the biomass of native animals was significantly less than that of modern day livestock.

Bill McKibben 350.org

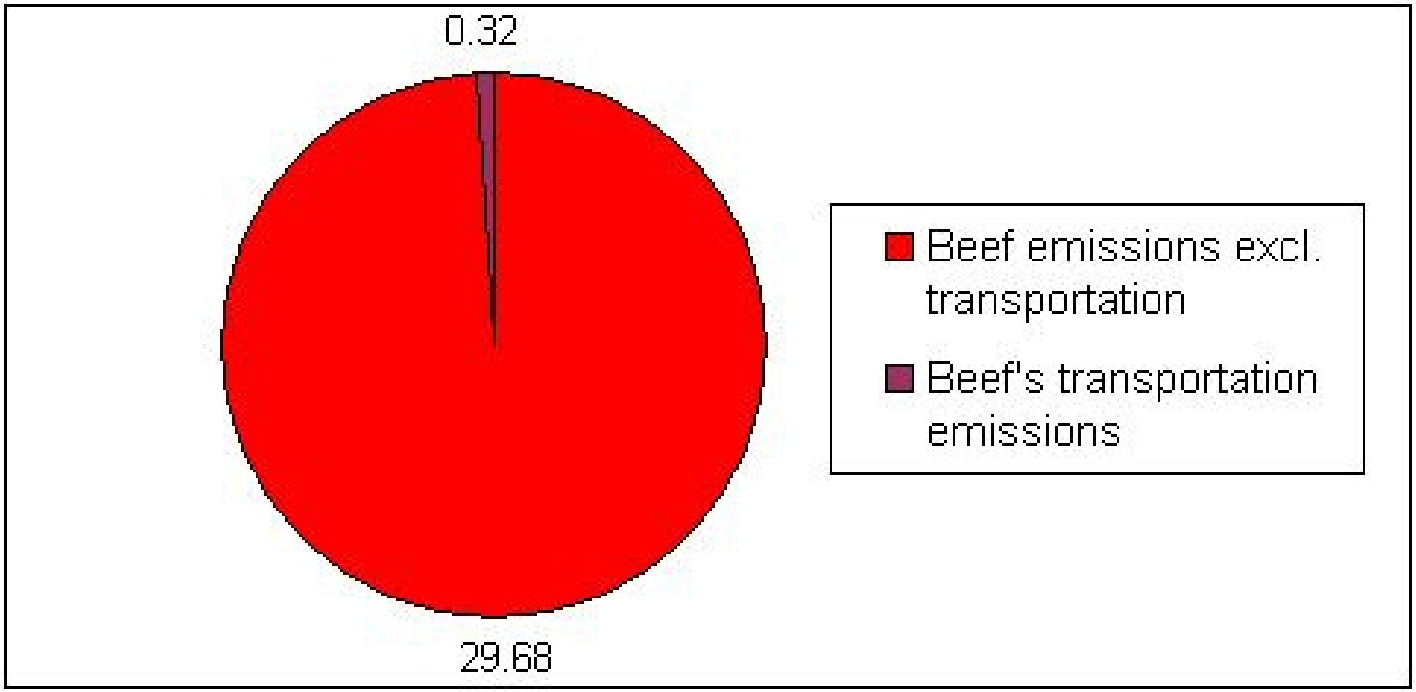
Livestock population



Russel, G. “Forget the quality, it’s the 700 million tonnes which counts“, 17 Nov 2009, http://bravenewclimate.com/2009/11/17/700-million-from-livestock/, citing Subak, S., “GEC-1994-06 : Methane from the House of Tudor and the Ming Dynasty“, CSERGE Working Paper, http://www.cserge.ac.uk/sites/default/files/gec_1994_06.pdf and Thorpe, A. “Enteric fermentation and ruminant eructation: the role (and control?) of methane in the climate change debate“, Climatic Change, April 2009, Volume 93, Issue 3-4, pp 407-431, http://link.springer.com/article/10.1007%2Fs10584-008-9506-x

Bill McKibben 350.org

Despite what McKibben says, buying Locally doesn't help much



Soy transport figure used here, as beef's was not specified in the relevant study. In this case, unlike soy, there appears to be no sea transport involved in the beef emissions figure. In the absence of a more precise figure, we have assumed that beef's transport-related emissions per kilogram of product are the same as those of soy, even though they are likely to be less.

Carlsson-Kanyama, A. & Gonzalez, A.D. "Potential Contributions of Food Consumption Patterns to Climate Change", The American Journal of Clinical Nutrition, Vol. 89, No. 5, pp. 1704S-1709S, May 2009, http://www.ajcn.org/cgi/content/abstract/89/5/1704S

James Hansen – Essential Measures

James Hansen, former Director of the Goddard Institute for Space Studies, NASA

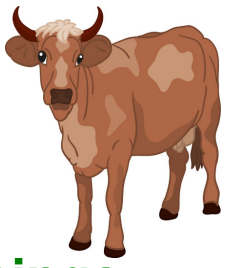
James Hansen – Essential Measures

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

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

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

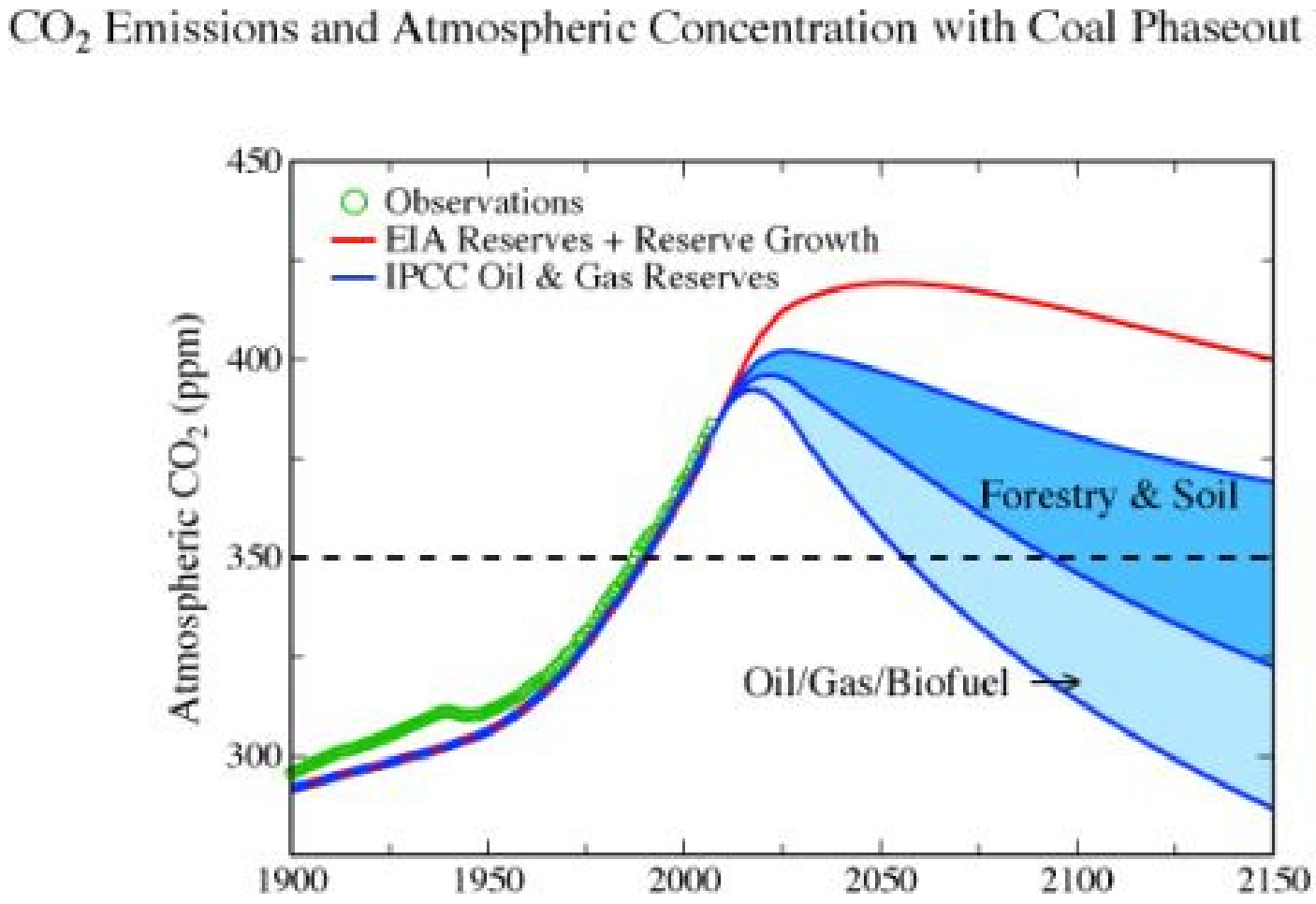
Not possible without addressing animal agriculture.



Hansen also discusses the importance of non-CO2 forcings. They include methane, nitrous oxide, tropospheric ozone and black carbon. Animal agriculture is a key contributor.

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.

James Hansen – Essential Measures

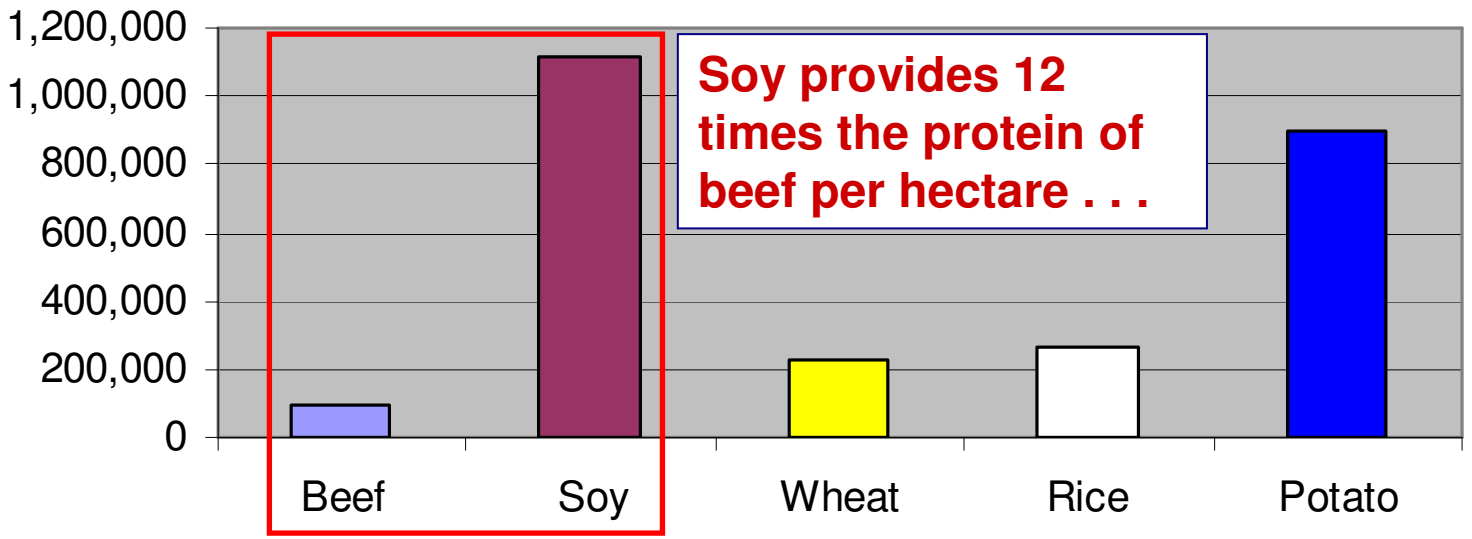


Source: Hansen, J; Sato, M; Kharecha, P; Beerling, D; Berner, R; Masson-Delmotte, V; Pagani, M; Raymo, M; Royer, D.L.; and Zachos, J.C. "Target Atmospheric CO2: Where Should Humanity Aim?", 2008.

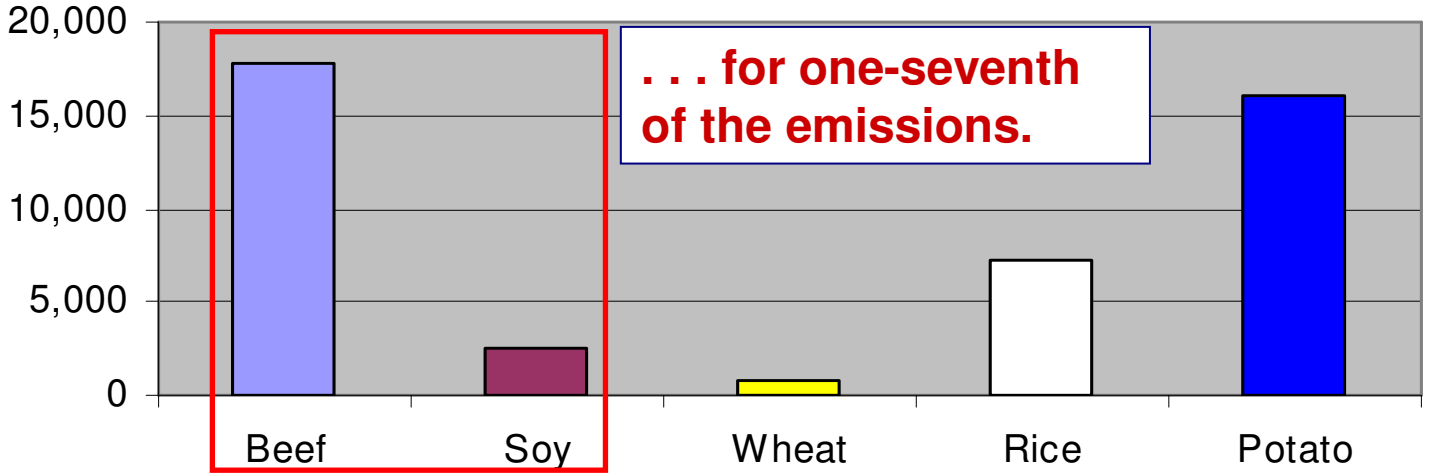
Nutrition – Meat & Livestock Australia
"Five essential ingredients in one amazing food"

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

Protein (g) per hectare

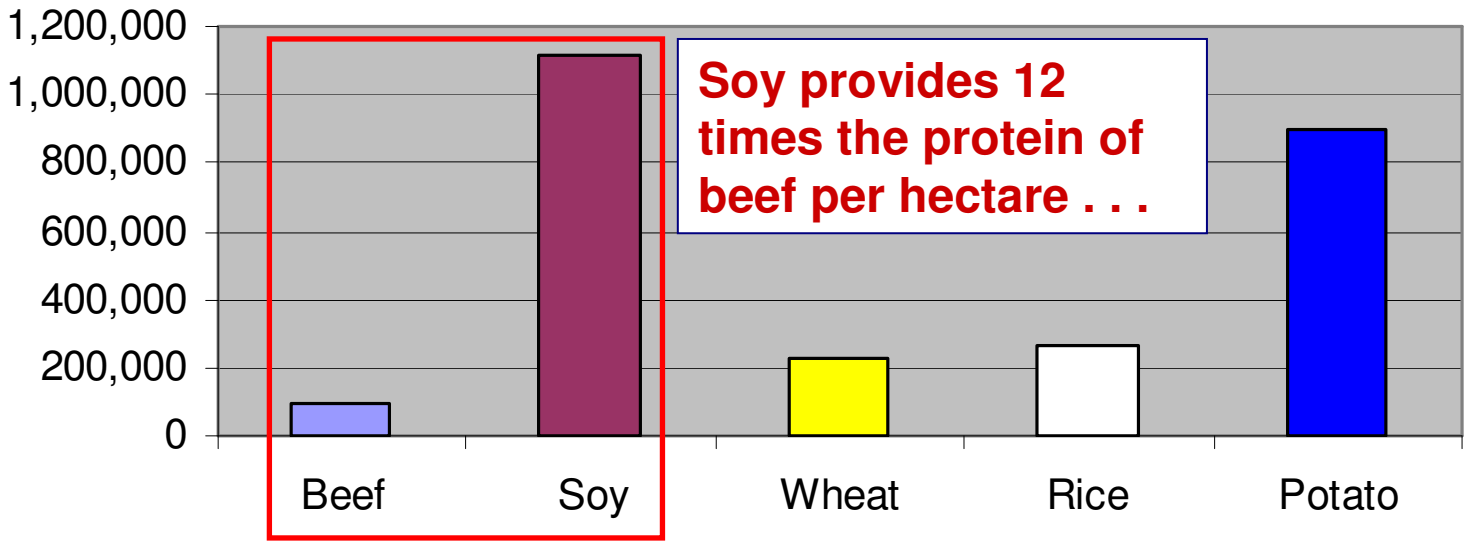


GHG per hectare

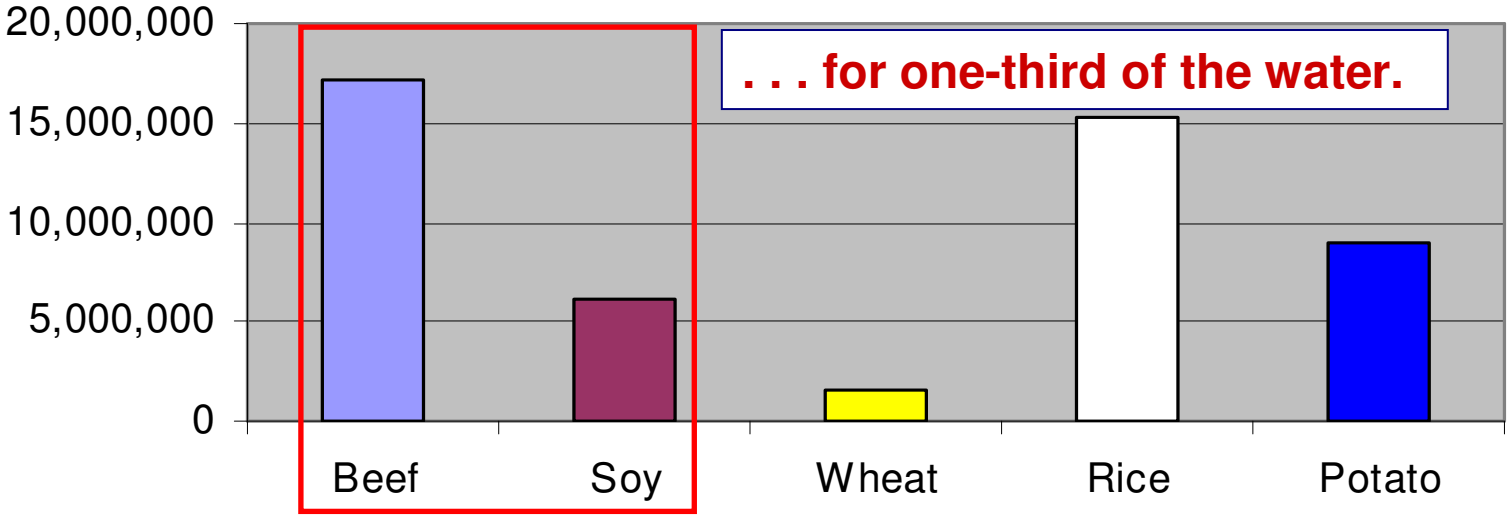


Source: Mahony, P, *"Some Environmental Impacts of Animal Agriculture, Part 2"*, updated Dec, 2010, http://dl.dropbox.com/u/1097247/bccag/images/animals2.pdf and Mahony, P for Vegetarian Network Victoria *"Submission in Response to Victorian State Government's Climate Change Green Paper"*, Sep 2009,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

Protein (g) per hectare

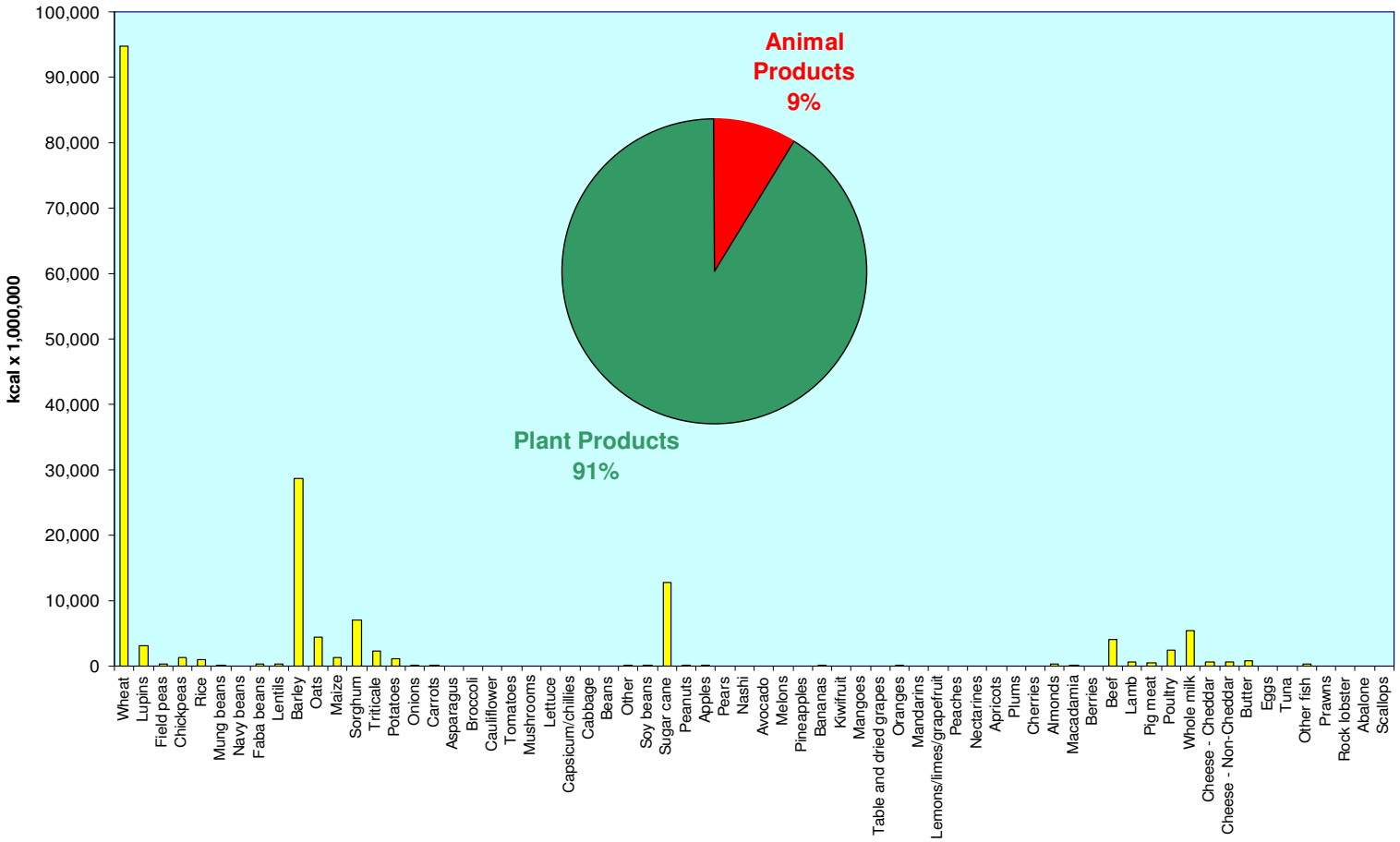


Water per hectare



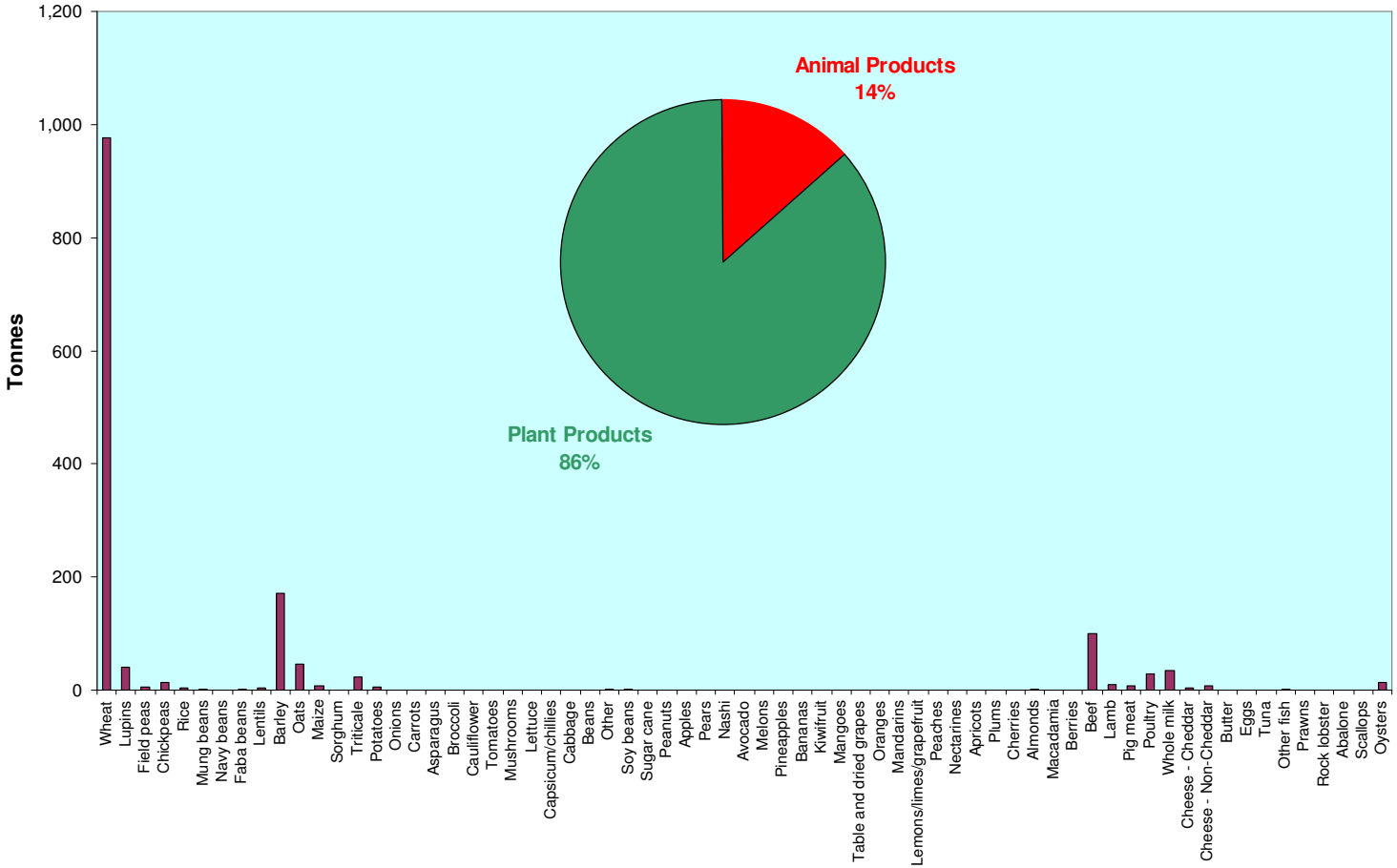
Source: Mahony, P, *"Some Environmental Impacts of Animal Agriculture, Part 2"*, updated Dec, 2010, http://dl.dropbox.com/u/1097247/bccag/images/animals2.pdf and Mahony, P for Vegetarian Network Victoria *"Submission in Response to Victorian State Government's Climate Change Green Paper"*, Sep 2009,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

Energy Value of food in Australia



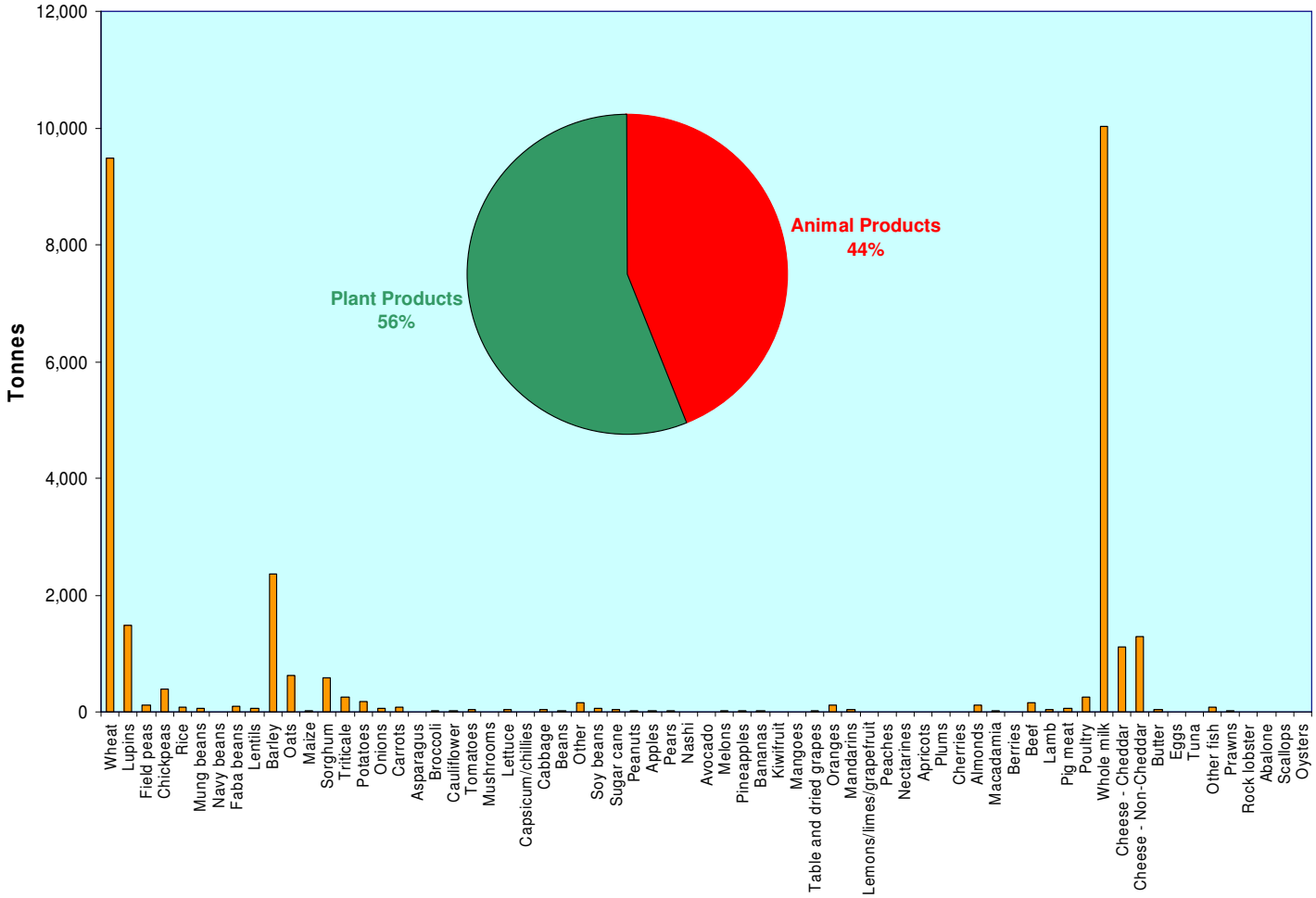
Livestock

Zinc Content

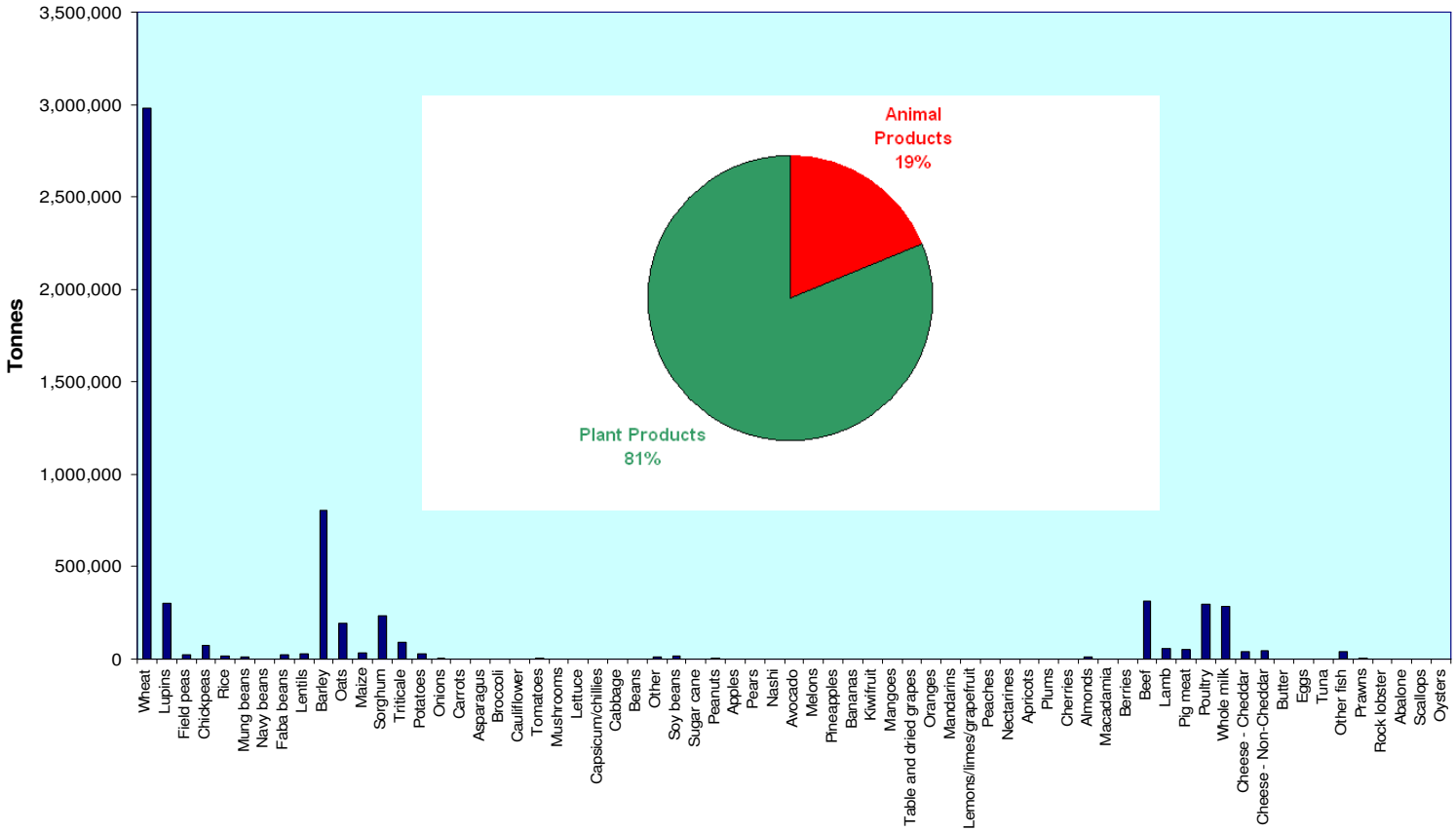


Livestock

Calcium Content

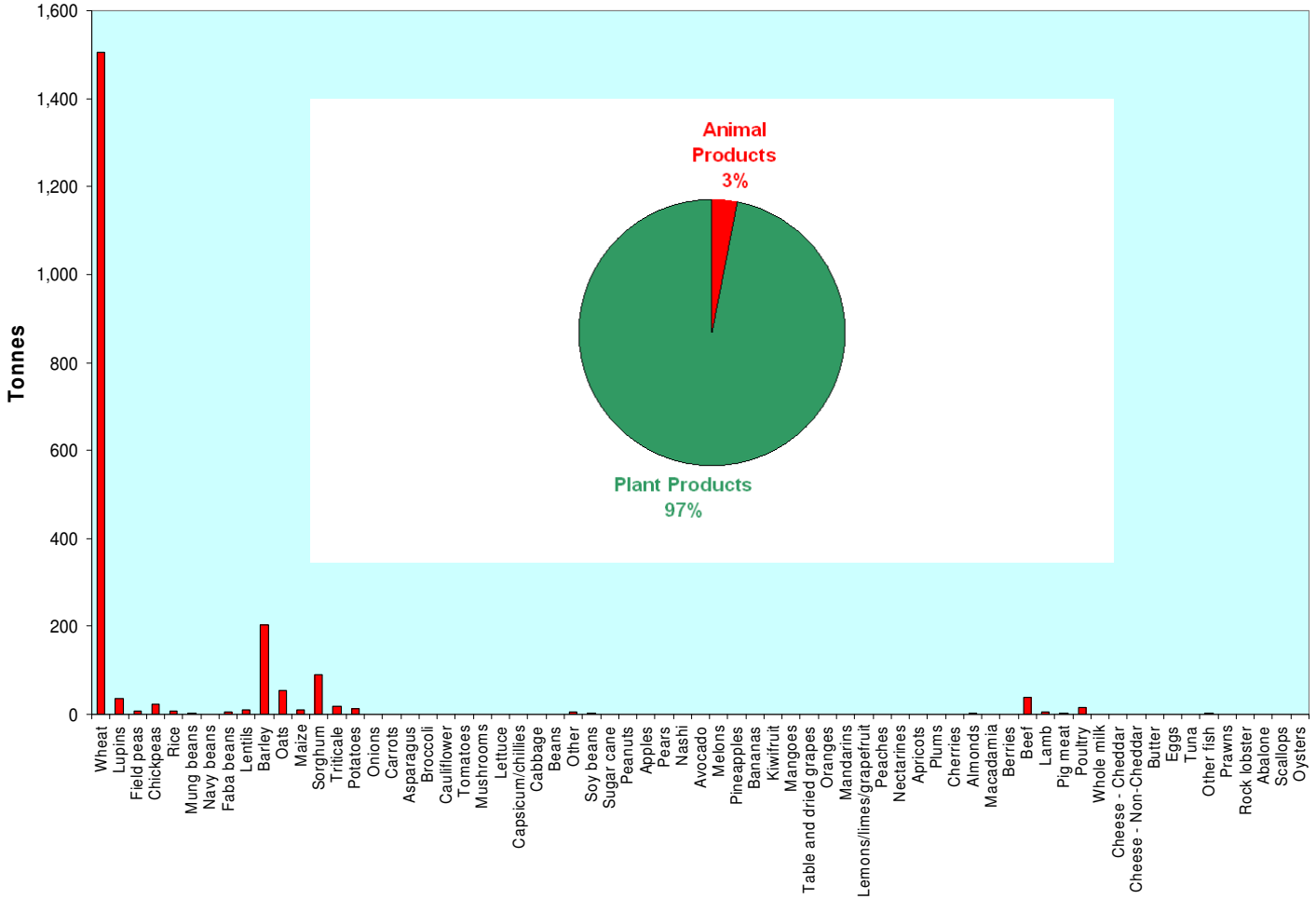


Protein Content



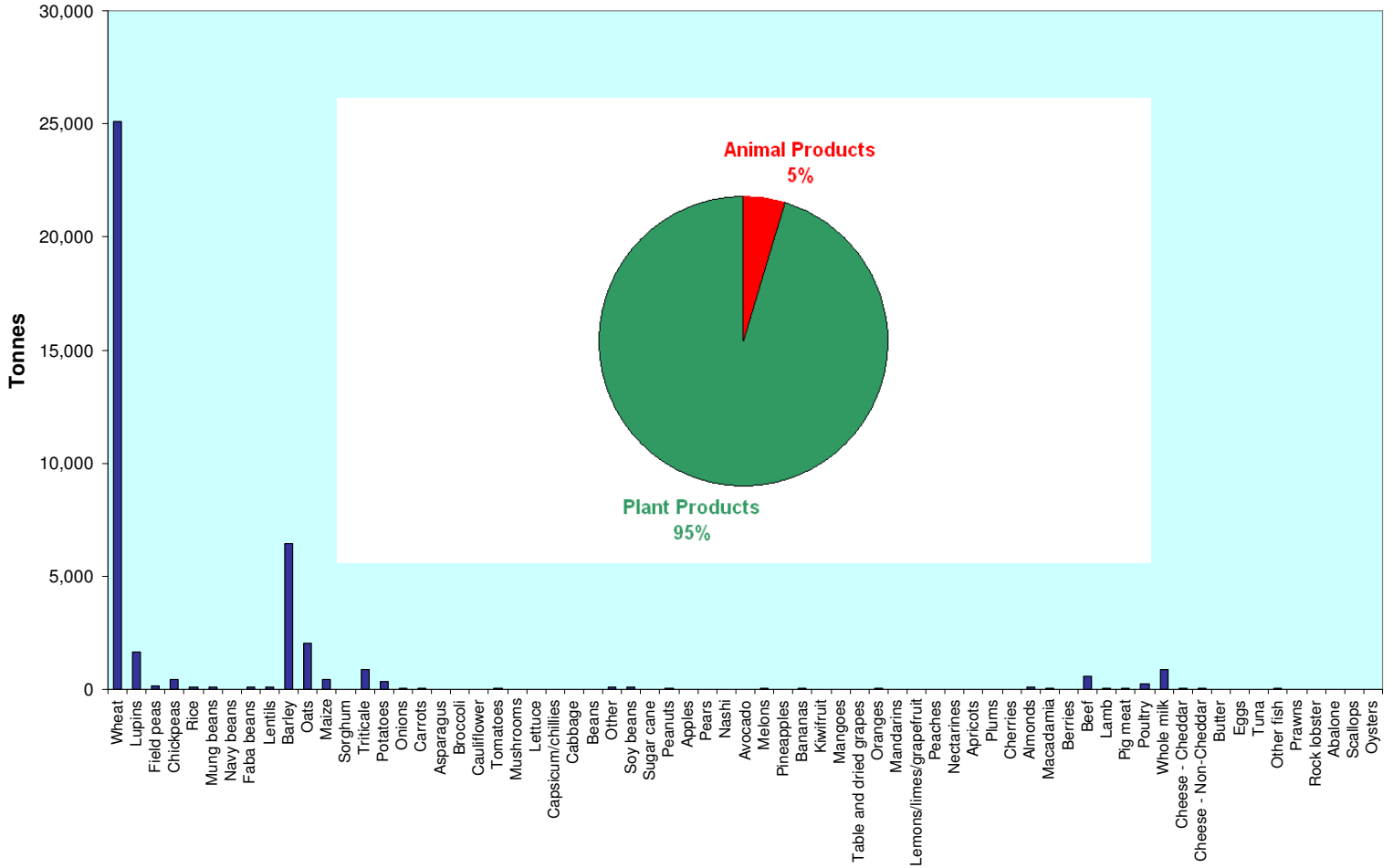
Livestock

Iron Content

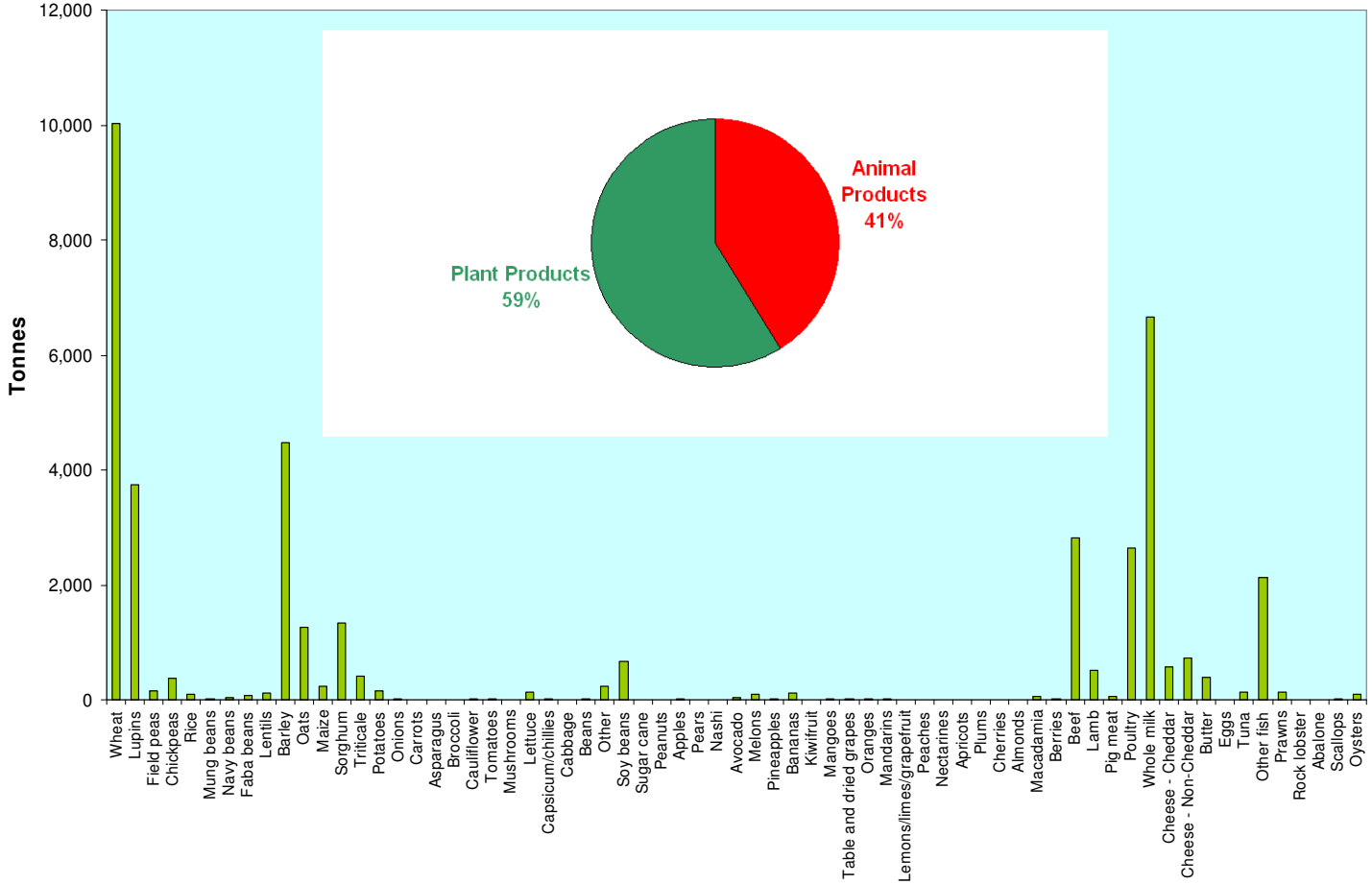


Livestock

Magnesium Content



Omega 3 Content



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

Some thoughts to conclude

Dr Andrew Glikson, earth and paleoclimate scientist at Australian National University

- *Contrarian claims by sceptics, misrepresenting direct observations in nature and ignoring the laws of physics, have been adopted by neo-conservative political parties.*
- *A corporate media maintains a 'balance' between facts and fiction.*
- *The best that governments seem to do is devise cosmetic solutions, or promise further discussions, while time is running out.*
- ***GOOD PLANETS ARE HARD TO COME BY.***

Source: Glikson, A., *"As emissions rise, we may be heading for an ice-free planet",* The Conversation, 18 January, 2012,http://theconversation.edu.au/as-emissions-rise-we-may-be-heading-for-an-ice-free-planet-4893 (Accessed 4 February 2012)