

Some Environmental Impacts of Animal Agriculture

Part 1

Updated December 2010

INTRODUCTION

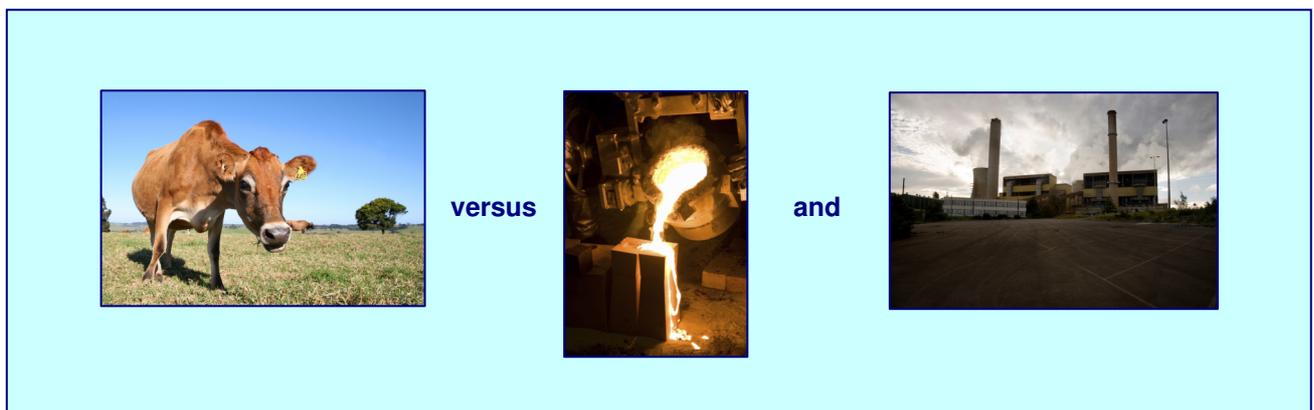
Concern over the environmental impact of animal agriculture has been expressed as follows by the United Nations Food & Agriculture Organization:

"Livestock are one of the most significant contributors to today's most serious environmental problems. Urgent action is required to remedy the situation."¹

They have also said,

"Perhaps even among the majority of environmentalists and environmental policy makers, the truly enormous impact of the livestock sector on climate, biodiversity and water is not fully appreciated."²

To provide some context to the consideration of livestock's impact, we have compared it to: (a) aluminium; and (b) coal-fired power; both of which are widely recognised as being extremely greenhouse gas (GHG) emissions intensive¹.



BEEF VS ALUMINIUM

Some key points to note in regard to aluminium are as follows:

- Aluminium smelting consumes around **16% of Australia's electricity**.³
- The emissions intensity of aluminium smelting in Australia is **around 2.5 times the global average** due to the fact that over 90% of the electricity used is generated by coal-fired power stations.^{4 & 5}
- *"Aluminium is the ultimate proxy for energy."* (Marius Kloppers, BHP Billiton CEO)⁶

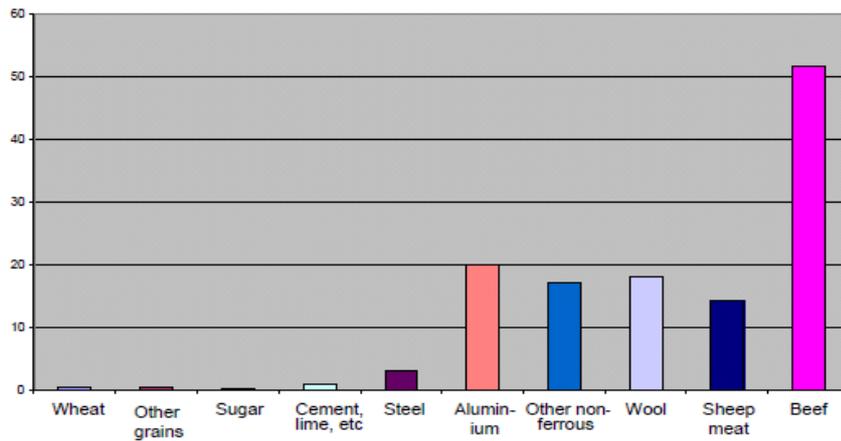
So how does beef compare?

It is more than **2.5 times** as emissions intensive as aluminium smelting!

The following chart depicts figures from an "end use" report commissioned by the Australian Greenhouse Office (now the Department of Climate Change) on the emissions intensity of various commodities in Australia, including beef and aluminium:^{7 & ii}

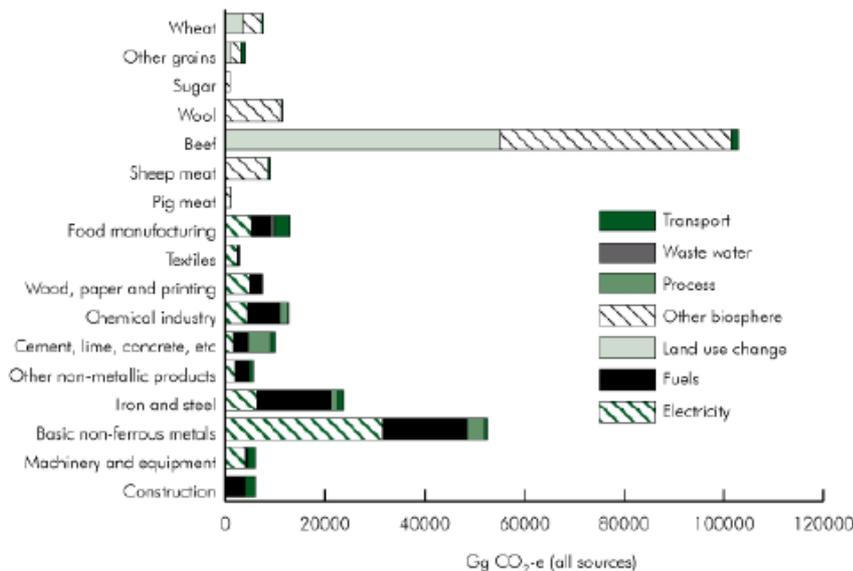
ⁱ Emissions intensity represents tonnes of GHG emissions per tonne of product.
ⁱⁱ Refer to note iv on page 3 regarding changing GHG emissions over time.

Comparative emissions intensity



The comparison in absolute terms is also dramatic, as **our annual tonnage of beef production is around 10% higher than that of aluminium.**^{8 & 9} The following chart (including aluminium within the category “basic non-ferrous metals”) from the same report compares emissions in absolute terms¹⁰:

Comparative emissions in absolute terms



The key reasons for beef’s high level of emissions are:

- deforestation for grazing and feed crop production;
- enteric fermentation within the animals’ digestive system, producing methane which is predominantly released through belching; and
- excrement which releases methane and nitrous oxide.

Much of the deforestation associated with livestock results from the grossly inefficient nature of meat as a food source for humans. For example, it takes around 13 kilograms of grain, fed to a cow, to produce 1 kilogram of meat.¹¹ When we convert foods like soy or corn to meat via the digestive system of animals, far more land is required than if those foods were consumed directly by humans. Similarly, forests are continually destroyed to make way for grazing land, when vast areas could be re-forested if we supplied our nutritional requirements by way of a plant-based diet.

LIVESTOCK (INCLUDING BEEF) VS COAL-FIRED POWER

Australia's National Greenhouse Inventory for 2008 (released in May, 2010)¹² 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.¹³
- Australia as a whole produced 549.5 megatonnes (*Section 4.1 "Overview"*).
- Emissions from livestock were around 59 megatonnes, including around 47 megatonnes from cattle (*Section 4.4 "Agriculture" and Table 15*).
- Beef cattle comprise around 94.5% of the nation's cattle population.^{14 & 15} (We have assumed an equivalent proportion of cattle's GHG emissions, i.e. around **44 megatonnes**.)
- 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.
- Net emissions from deforestation in 2008 were 49.7 megatonnes (*Section 4.6*).
- The Australian Greenhouse Office's 2003 "end use" report (referred to on page 2) indicated that 85.1% of cleared land in Australia during the most recent reporting period (1999) was used for cattle grazing.¹⁶

Applying the clearing figure of 85.1% to the 2008 deforestation emissions produces a figure of around 42 megatonnes, with beef cattle's share (94.5%) being **40 megatonnes**. (We have not allowed for any proportion of the 10.4% of cleared land used for cropping that may be devoted to cattle feed crop.)

Based on these figures, **beef cattle are responsible for approximately 84 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.¹⁷

The above figures indicate that the annual GHG emissions from beef cattle in Australia are equivalent to: (a) 41% of the emissions produced from our (mainly coal-fired) electricity generation; (b) 5.25 times the emissions from the nation's most GHG intensive major power station, Hazelwood in Victoria; and (c) 1.33 times the entire emissions from electricity generation in the State of Victoria (population 5.5 million¹⁸).

These comparisons are demonstrated on the following page.^{iii & iv}

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.¹⁹

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.²⁰

iii 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)

iv The extent of any sector's contribution to deforestation will vary over time, and it is possible that the beef industry's share of deforestation has reduced from the figure of 85.1% referred to above due to a ban on broadscale land clearing in Queensland with effect from January, 2007. However, the results contained in this report reflect an overall reduction in deforestation in recent years and are consistent with the emissions intensity figures used by Professor Barry Brook and Geoff Russell in their article "*Meat's Carbon Hoofprint*", which was published in the November/December, 2007 issue of *Australasian Science* (see reference no. 20). In any event, with growing demand for beef from Asia (and probably domestically) there may be pressure to re-introduce broadscale land clearing, much like the recently-elected Coalition Government in Victoria intends re-introducing cattle grazing in that state's high country, reversing the ban that was introduced in 2005. It is also important to note that while cleared land continues to be used for cattle grazing, it cannot be re-forested. Since European settlement of Australia, livestock are responsible for approximately 70% of deforestation.

It is critical for the integrity of our planet's climate system that we end our reliance on coal-fired power. However, animal agriculture, including beef production, should receive no less attention. (Refer to "What you can do" on page 5.)

Comparative GHG emissions: beef production and electricity generation in Australia^v



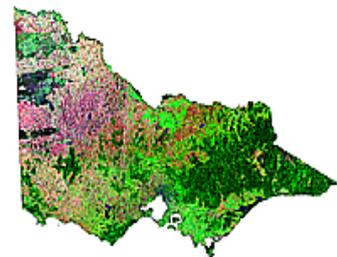
GHG emissions from Australia's beef cattle are equivalent to:



41% of the emissions from the nation's (mainly coal-fired) electricity generation . . .



. . . 5.25 times the emissions from Victoria's Hazelwood Power Station and . . .



. . . 1.33 times the entire emissions from electricity generation in the State of Victoria.

20 YEAR GWP^{vi}

The preceding comparisons have been based on a on a 100-year GWP (i.e. global warming potential).

A 20-year GWP (see next paragraph) may be more valid than the 100-year figure when considering the impact of livestock, because methane, a critical factor in livestock's greenhouse effects, generally breaks down in the atmosphere in 9–12 years. Accordingly, a 100-year GWP (which shows the average impact over a period of 100 years) greatly understates methane's shorter-term impact.

Each year, Australia's livestock (including beef) produce around 3 million tonnes of methane. According to the Intergovernmental Panel on Climate Change, methane's greenhouse impact is 72 times stronger over a 20 year time horizon than carbon dioxide's (i.e. methane's 20-year GWP is 72).

Accordingly, those methane emissions equate to around 216 megatonnes of carbon dioxide. This means:

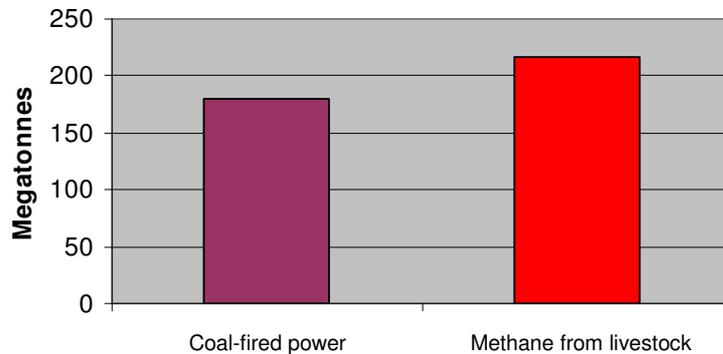
Based on a 20-year GWP, livestock in Australia produce more CO₂-equivalent emissions than all our coal-fired power stations combined.^{20 & 21} This comparison only takes into account livestock's methane emissions, and not: (i) their nitrous oxide emissions; or (ii) deforestation for grazing and feed crop production.

^v As indicated on page 3, the comparisons will vary from one time period to another. At times, beef's contribution has been significantly higher than indicated, while at others it has been lower.

^{vi} The emissions of different gases can be aggregated by converting them to carbon dioxide equivalents (CO₂-e). 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.

The comparison is depicted as follows:

**Annual CO₂-e emissions based on 20-year GWP
Coal-fired power versus methane from livestock**



Note: The comparison does not allow for the deforestation or nitrous oxide (primarily manure management) impacts of livestock, which are significant.

- Although methane may have a shorter life than carbon dioxide (which remains in the atmosphere for many hundreds of years), its impact can be long term if it contributes to us reaching tipping points that result in positive feedback loops with potentially irreversible and catastrophic consequences.
- On the positive side, the relatively short term nature of methane's impact means that action on livestock production can be one of the most effective steps available to us in dealing with climate change.

CONCLUSION

The world's population is running out of time to avoid the catastrophic effects of runaway climate change.

Subjects such as diet must not be regarded as taboo, and must feature heavily in the choices that we make in order to save our planet for all species and future generations. We can no longer regard food choices as being personal when the impacts of those choices have far-reaching consequences for our natural resources and climate change.

What you can do

Individuals:

- Consume fewer livestock products, particularly beef, lamb, dairy and wool.
- Inform others.

Environmental Groups:

- Include animal agriculture as a high priority in campaigning efforts directed at the community and governments.

Governments:

- In regard to those factors within their control, ensure that all relevant costs (including environmental costs) are incorporated in the price of agricultural products.
- Inform the community, so that consumers can make purchasing decisions based on adequate knowledge.

The above governmental measures would assist markets to operate efficiently, which is often the professed, though often not the practiced, aim of governments.

Prepared by Paul Mahony in August, 2010 and last updated on 12 December 2010

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