Emissions comparison grazed vs. destock (fire)

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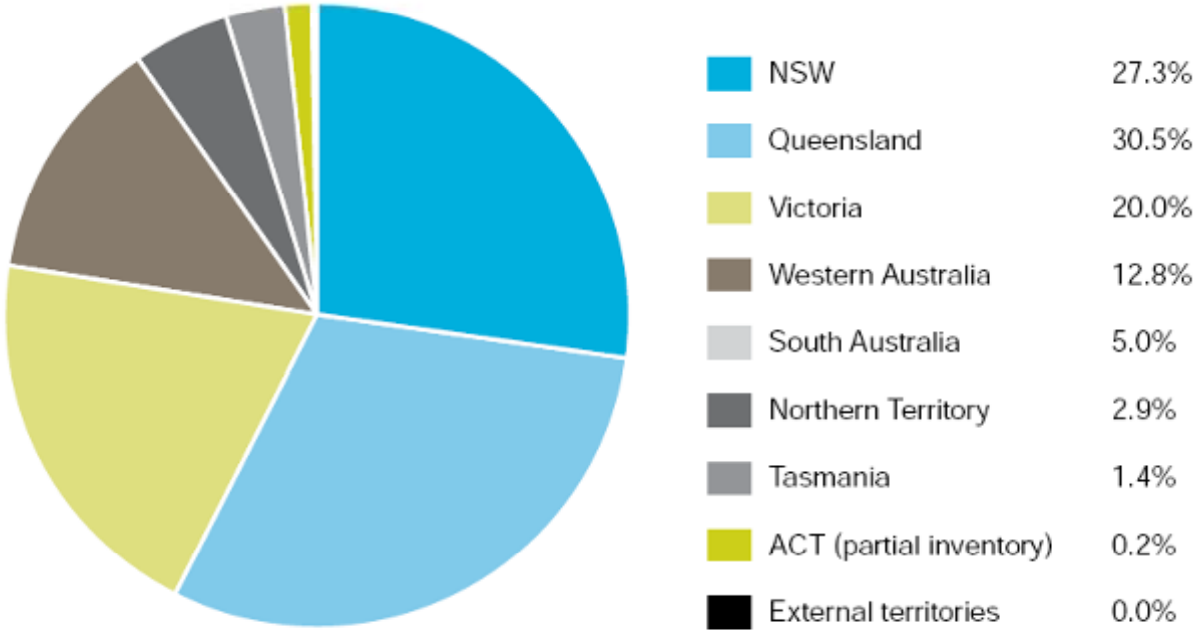
Queensland Government

Overview

- Australia’s and Queensland's greenhouse position
- Work on understanding the impact on Qld beef grazing businesses
- Work through an example
  - Grazed versus Destocked property

Figure 2: State and Territory Shares of National Emissions, 2007

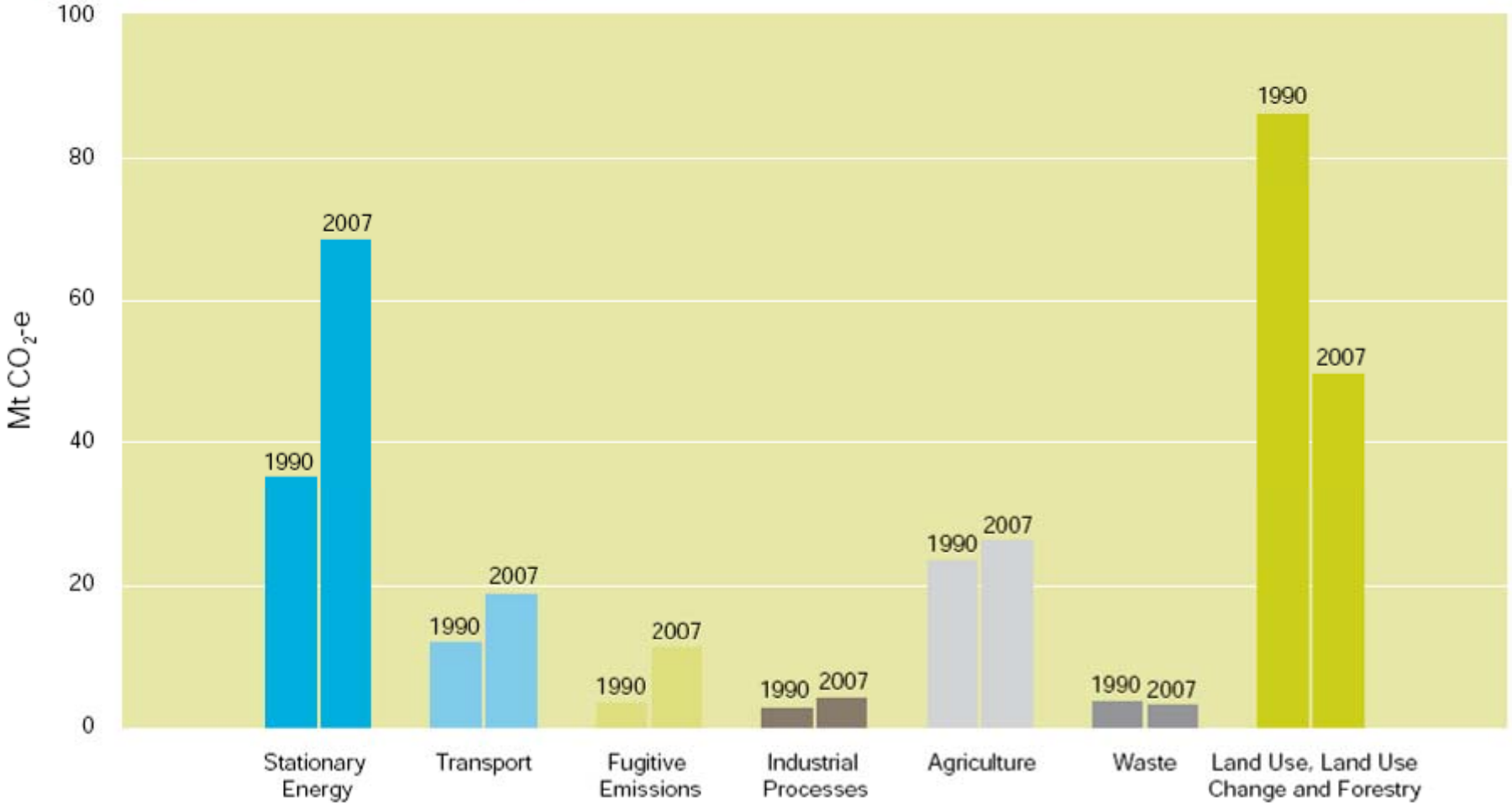


Australia's emissions were estimated at 597.2 Mt CO2-e in 2007

Qld 181.6 Mt CO2-e in 2007

Dept of Climate Change 2009

Figure 6: Queensland – Emissions by Sector, 2007



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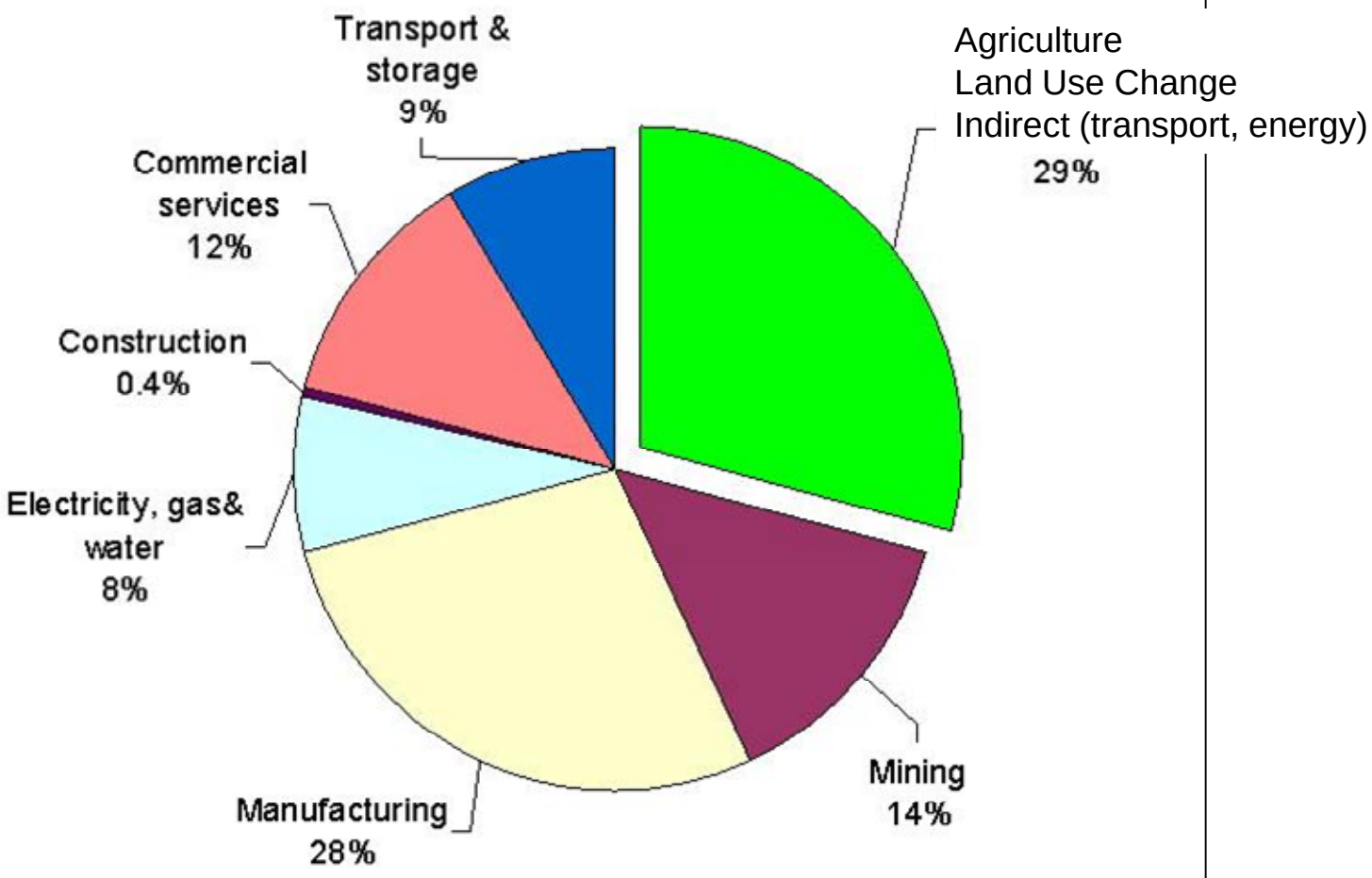
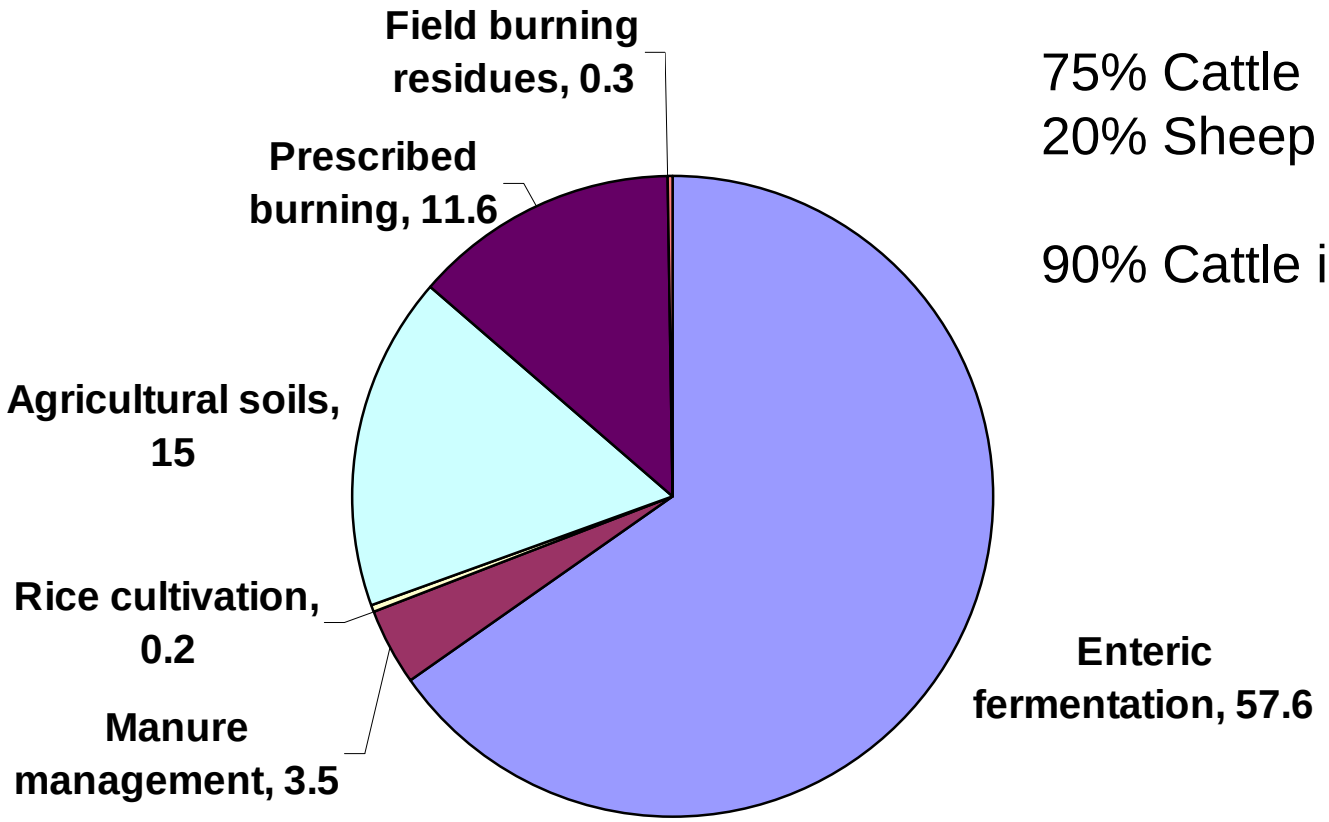
Emissions attributable to Australian industry by sector, 2006



Sources: DCC (2008); ABS (2007) after Garnaut (2008)



75% Cattle
20% Sheep

90% Cattle in Qld

Agriculture sector Mt CO_2-e emissions, 2007 (DCC 2009)

Question

- Request following 3C's seminar series early 2009
- Prepare a greenhouse impact comparison of grazing versus destocking
- Explain the calculations (therefore technical)
- Discuss the trade-offs
  - Particularly methane emissions versus burning emissions
- 1 t C equals 3.67 t CO_2-e
- Use local data
- Inputs and removals from atmosphere
- Not necessarily Kyoto compliant

Past work on Qld grazing greenhouse

- Woodland thickening (Burrows, CRC Greenhouse Accounting)
  - Woodland monitoring, soil carbon isotope assessment (site on Strathdarr)
  - Carbon content of different sized and types of trees

- Impact of land condition on soil carbon stocks across Queensland
  - Northern Gulf and Upper Burdekin (CFOC, Northern Gulf)
  - Wambiana, Toorak (DAFF, CSIRO, DERM)
  - Ecograze and exclosures

- Fire research in NT, livestock methane in Rocky (CSIRO)

- Impact of tree management on property greenhouse budget (Rangeland Jnl)

- Agroforestry bioeconomic assessment in CQ (RIRDC, CSIRO, QPIF)
  - Trade-off between trees and livestock carrying capacity

- Net carbon position of the Qld beef industry (ongoing)

Analysis structure

- Describe an indicative property and what is analyzed
- Discuss background and issues to be considered
- List assumptions and indicate strength of data
- Grazed property outcome
- Destocked property outcome
- Difference (Destocked – grazed)
- Compile the components at end

Property – Mitchell grass

- Property data derived from discussion with Errol Entriken and D. Phelps (NGS input)
- 14,000 ha, ~34,300acres
- 8 ha per cattle AE (455 kg); carrying capacity 1750 AEs (~14,000 sheep)
- 15% timber cover (gidyea, gidyea regrowth 5%, wooded downs)(SLATS 2006)
- Land condition 20% A; 45% B; 30% C and 5% D (Phelps pers. comm.)

Stocks or emissions assessed

Assessed carbon stocks and greenhouse emissions including:

- Livestock methane
- Property emissions
- Livestock biomass and turn-off
- Forage and litter biomass
- Savanna burning
- Tree biomass
- Soil carbon and soil emissions

Methane emissions

Ed Charmley has previous outlined the issues and considerations

Grazed

- 1.5 t CO_2-e per AE per year (Charmley pers. comm.)
- 1750 AEs = 2625 t CO_2-e per year
- Methane emissions proportional to livestock number

Destocked

- No cattle emissions

Difference (Destocked – Grazed)

- 2625 t CO_2-e (emission with grazing)

Property energy emissions (Grazed)

Includes fuel, electricity (indirect emissions) and LPG

Grazed

- 0.009 t CO_2-e per ha based on 10 central Qld properties
- Are western Qld properties less energy intense? Longer travel distances

- 126 t CO_2-e for the property including house

- Average Qld household emissions 14 t CO_2-e per year
- If assume 1 residence per property
- 112 t CO_2-e for grazing business

- Assume no clearing emissions

Property energy emissions (Destocked)

Destocked

- No water pumping
- Household emissions?

- Energy emission attributed to external management, fire control etc.

- Assume quarter of grazed property emissions 28 t CO_2-e

Difference (Destocked – grazed)

- 98 t CO_2-e (emissions saved)

Livestock biomass turnoff/export

Grazed

- 455 kg, 40% dry matter, 50% carbon
- 584 t CO_2-e biomass

- 204 t CO_2-e turnoff/export off property
- based on average 35% turnoff of AEs

Destocked

- none

Difference (Destocked – grazed)

- 584 t CO_2-e (extra biomass in livestock)
- 204 t CO_2-e turnoff/export off property

Forage and litter biomass

Grazed (long term average)

- 1.5 t per ha forage (2.8 t CO_2-e per ha)
- 1 t per ha litter (1.9 t CO_2-e per ha) (litter 70% of forage)
- 65,500 t CO_2-e for the property

Destocked

- Assume little water, minimal roos
- 2.5 t per ha forage (4.6 t CO_2-e per ha)
- 1.8 t per ha litter (3.2 t CO_2-e per ha)
- 109,100 t CO_2-e for the property

Difference (Destocked – grazed)

- 43,600 t CO_2-e (extra grass biomass on destocked)

Savanna burning (Grazed)

Grazed

- Emissions factor 0.17, based on 2.5 t per ha fuel (grass and litter) (don't count CO_2)
- Fire frequency, issue with regularity and percentage of property burnt, fire suppression
- 1 fire in 20 years; 5% of property burnt each year
- 1 fire in 40 years; 2.5% of property burnt each year
- Firescar mapping indicates 0.025% burnt per year 2007 and 2008

- 119 t CO_2-e for the property (5% burnt per year)

Phelps

Savanna burning (Destocked)

Destocked

- Emissions factor 0.29, based on 4.25 t per ha fuel
- What fire suppression will be conducted?
- 1 fire in 4 years; 25% of property burnt each year

- 1015 t CO_2-e for the property (25% burnt per year)

- If all burnt in one year 4060 t CO_2-e for the property

Difference (Destocked – grazed)

- 896 t CO_2-e (extra emissions from fire with Destocking, 25% burnt per year)

Phelps

Woody vegetation (grazed)

Grazed

- 15% of property has tree cover
- Basal area 4 m^2/ha in trees, 2 m^2/ha regrowth and 0.1 m^2/ha in grassland

- Woody biomass stock 128,800 t CO_2-e for the property

Change in trees

- Assume no impact from infrequent burning and no clearing
- Assume slow thickening up and encroachment of woody veg. into grassland
- 0.032 m^2/ha/yr in trees; 0.1 m^2/ha/yr in regrowth; 0.0032 m^2/ha/yr in grassland

- Woody biomass change 810 t CO_2-e per year

- Note livestock carrying capacity will slowly decline over time.
- Re-clearing regrowth will emit, current biomass 16,300 t CO_2-e

Woody vegetation (destocked)

Destocked

- Initial tree biomass the same as grazed: 128,800 t CO_2-e for the property
- Does tree biomass stay the same or decline with destock and fire?
- If assume no change in trees: Woody biomass change 0 t CO_2-e

- Assume trees decline 30% over 30 years:
- Woody biomass declines 1288 t CO_2-e per year (emission)

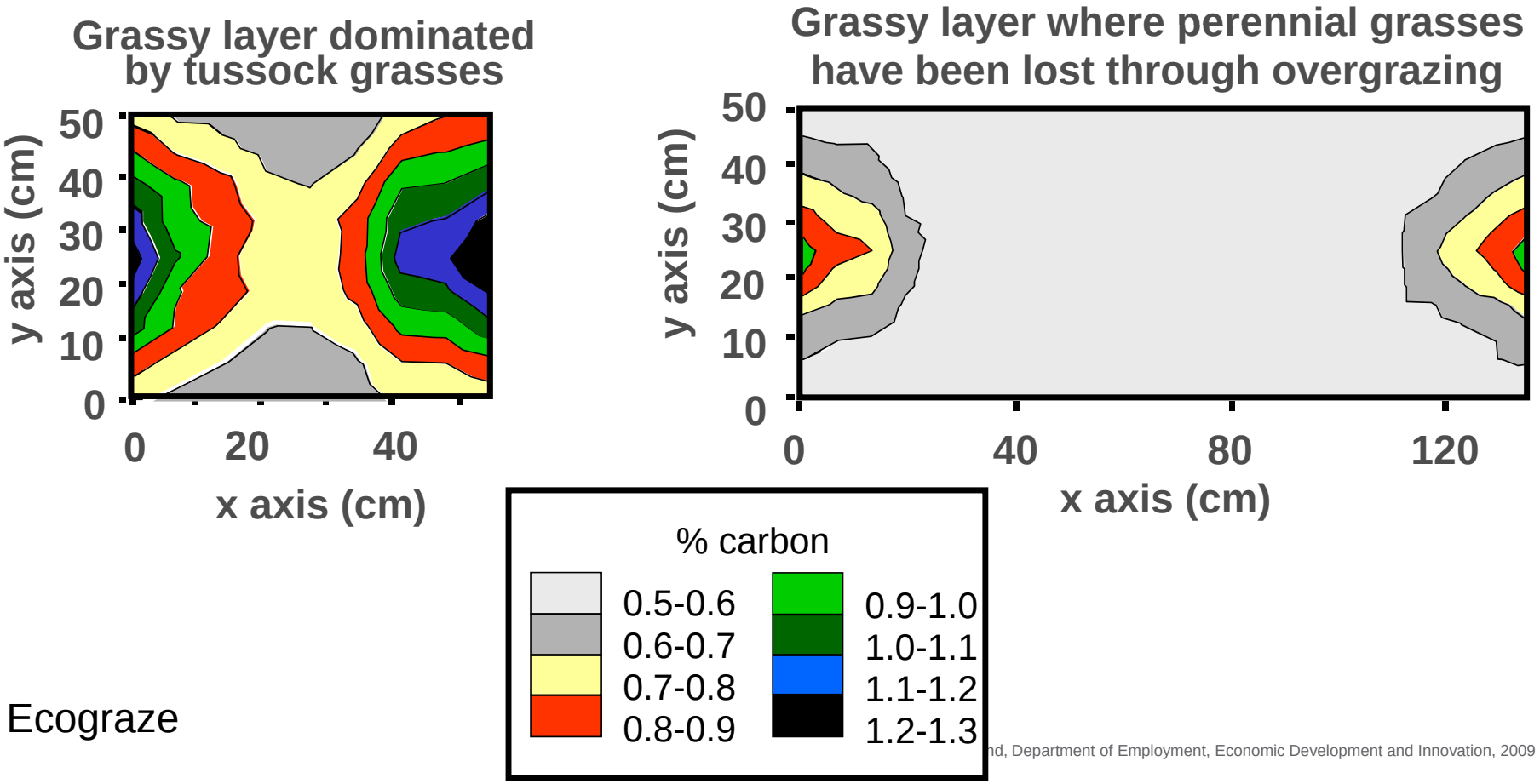
Difference (Destocked – grazed)

- Grazed 810 t CO_2-e per year sequestration
- Destock 0 or 1288 t CO_2-e per year emission

Soil carbon and land condition

A decline in perennial grasses disrupts organic matter & nutrient cycling

More perennial tussocks = more soil carbon (Ash et al. 1995)



Ecograze

Soil carbon (Grazed)

- 73 t CO_2-e per ha in top 30cm in good condition (Smith 2000)
- 1,027,000 t CO_2-e per property in A-condition in top 30cm (soil potential)
- Land condition 20% A; 45% B; 30% C and 5% D
- Assume soil carbon only changes in top 10cm
  - (deeper layers total carbon is old >100 yrs)
- 934,000 t CO_2-e per property in current condition in top 30cm
- 93,000 t CO_2-e per property missing due to poor land condition

Soil carbon (Grazed)

- Assume 70% of C-condition can be improved to B-condition over 25 years
- 954,000 t CO_2-e per property in improved condition in top 30cm
- Gain 800 t CO_2-e per year
- Can this be done?
- What if land condition declines?

Soil carbon (Destocked)

- 934,000 t CO_2-e per property in current condition in top 30cm (same)

- How does soil carbon change with destocking and increased fire?
- Little research

- Consider two options

- Surface soil carbon can be lower in exclosed sites
- 7% lower on average across 12 sites (Carter and Fraser 2009)
- Timeframe: assumed 20 years

- 907,000 t CO_2-e per property after destock
- Loss 1350 t CO_2-e per

Soil carbon (Destocked)

- 93,000 t CO_2-e per property missing due to poor land condition (same)

Land condition may improve

- Assume change to 70% A; 20% B; 5% C and 5% D
- Timeframe: assume 50 years

- 993,000 t CO_2-e per property after destock
- Gain 1180 t CO_2-e per year

- Can this be done?

Soil Emissions

- Includes nitrous oxide emissions and methane emissions or adsorption
- Very little data on size of emissions in Queensland grazing land
- Global review indicates 0.26 t CO_2-e per ha per year
  (0.28 Nitrous Oxide and -0.02 methane)

- What is the impact of management???

- Assume no impact of management
- 3640 t CO_2-e per property per year emission

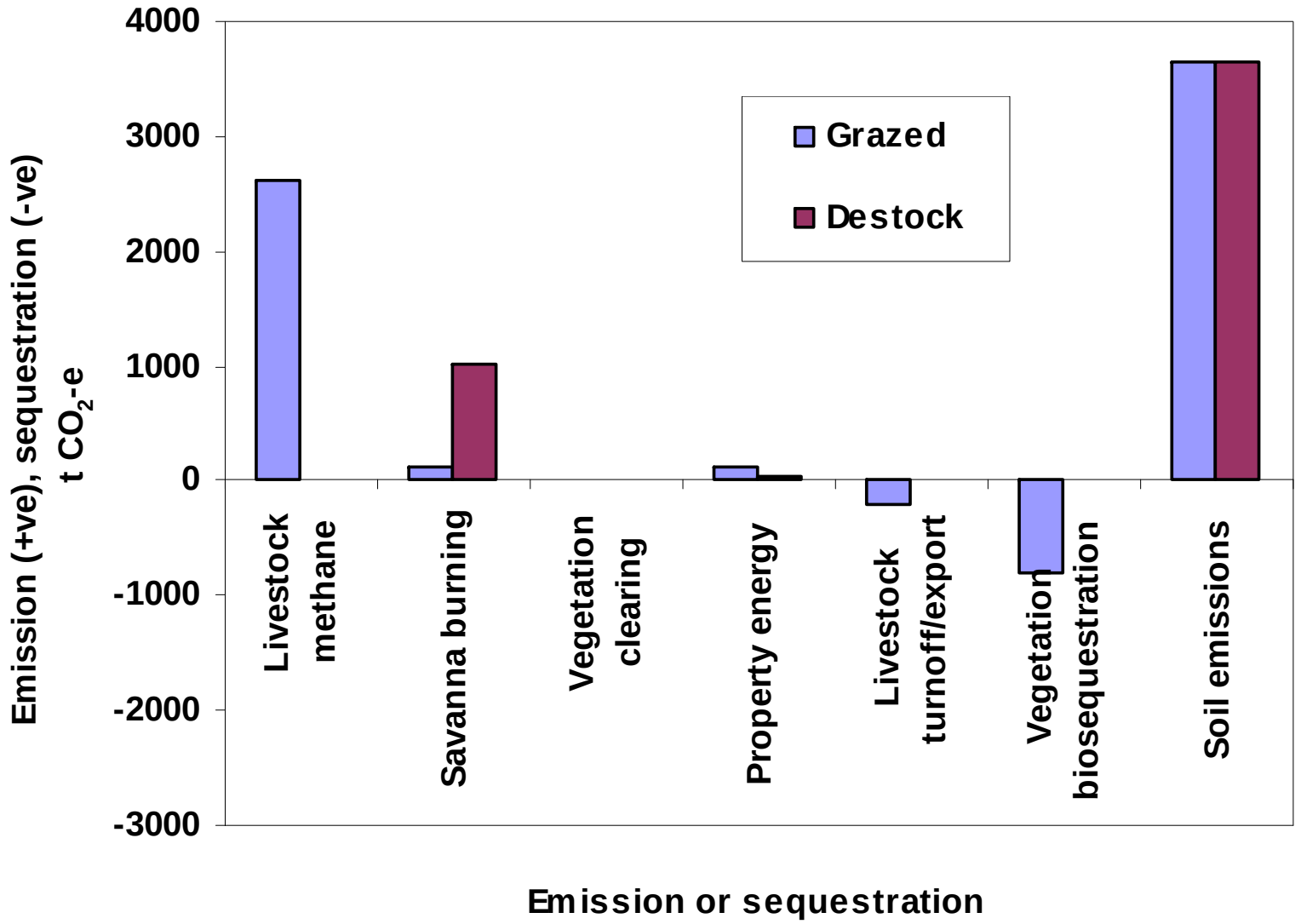
Difference (Destocked – grazed)

- Assume none

Results (t CO2-e per property)

	Grazed	Destocked
Methane	2625	0
Energy	112	28
Savanna Burning	119	1015
Tree clearing	0	0
Total Emissions	**2856**	**1043**
Soil emissions	3640	3640
Livestock off-take	-204 (seq)	0
Trees	-804 (seq)	0 to 1288
Soil carbon	-800 (seq)	1350 to -1180 (seq)

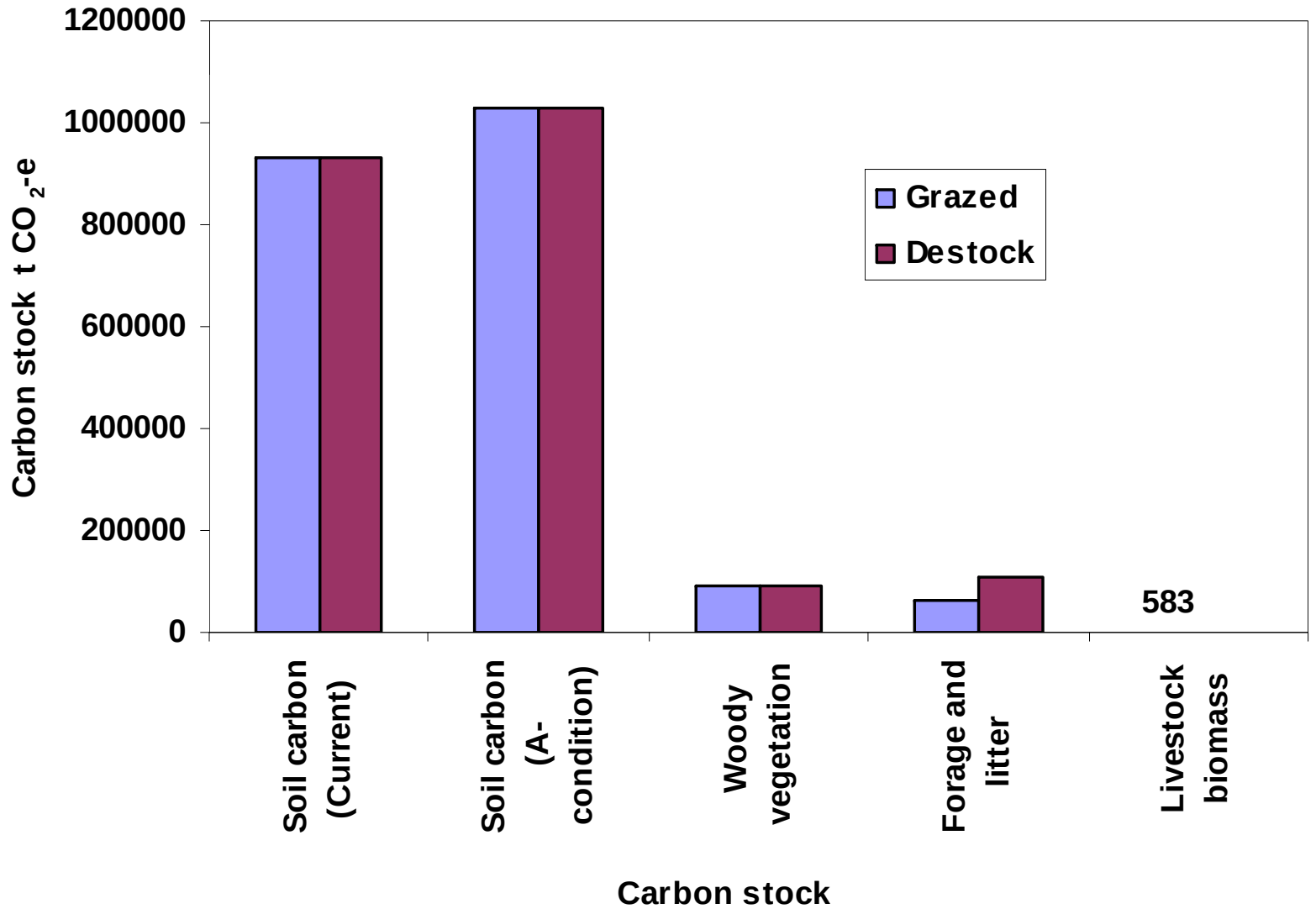
Emissions



Biomass stocks

	Grazed	Destocked
Total Emissions (not soil)	2856	1043
Livestock biomass	584	0
Grass and Forage	65,500	109,100
Trees	128,800	128,800
Soil carbon	934,000	934,000
Total Biomass	1,129,000	1,231,000

Carbon stocks

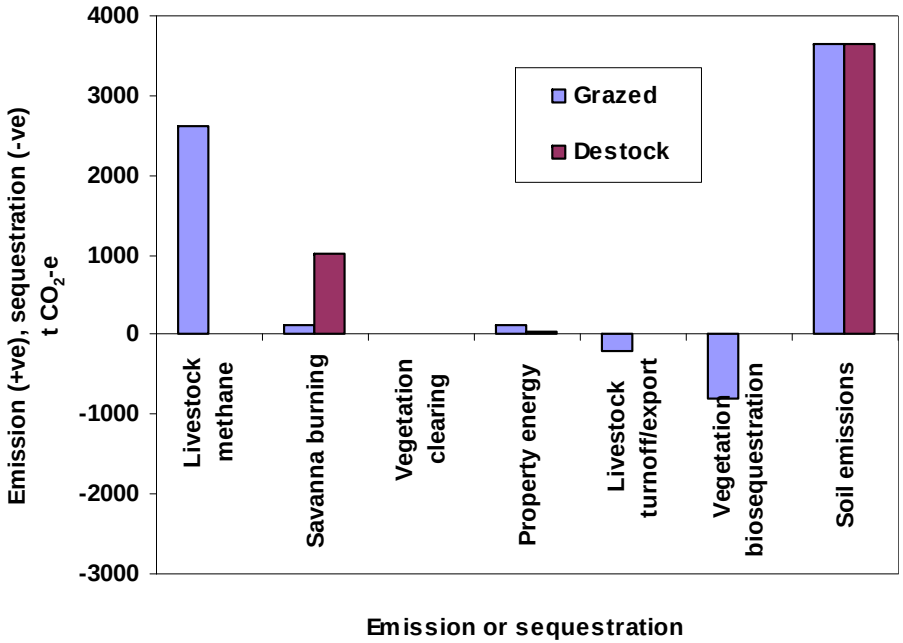


Conclusion

Emissions reduction **and** a profitable beef industry are possible

- There is scope for the beef industry to manage emissions
- Still much uncertainty with measuring and understanding change, but principles are available
- Policy and rules allowing emissions to be offset by sequestration elsewhere in the business will be important.

Emissions/Sequestration



Carbon stocks