Whole farm systems analysis of the greenhouse gas emissions of Australian dairy farms

Karen Christie, Cameron Gourley, Richard Rawnsley

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Australian Government
Department of Agriculture, Fisheries and Forestry

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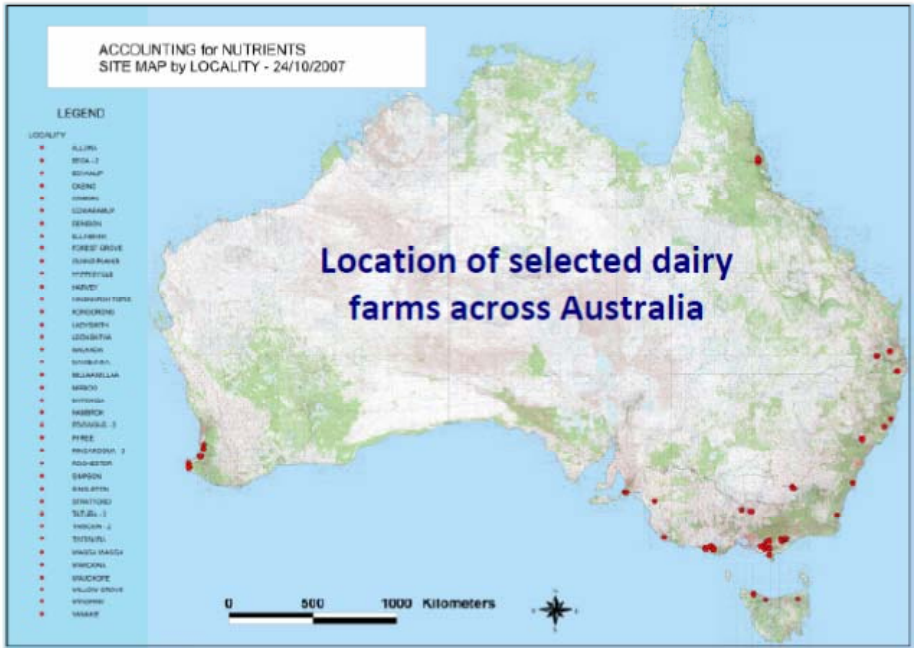
Presentation overview

- Accounting for Nutrients (A4N) project
- Estimating the GHG emissions
- Greenhouse gas emission results
- Influence of regional location on GHG emissions intensity
- Influence of level of grain feeding on GHG emissions intensity
- Influence of farming system on GHG emissions intensity

A4N dataset

- 41 farms from throughout Australia
- Data originally collected to undertake nutrient budgets but could be assessed for GHG emissions
- Diversity of farms with varying farm and herd sizes, levels of milk production per cow, level of grain and other supplementary feeding and also varied from being predominantly pasture-based through to partial mixed rations



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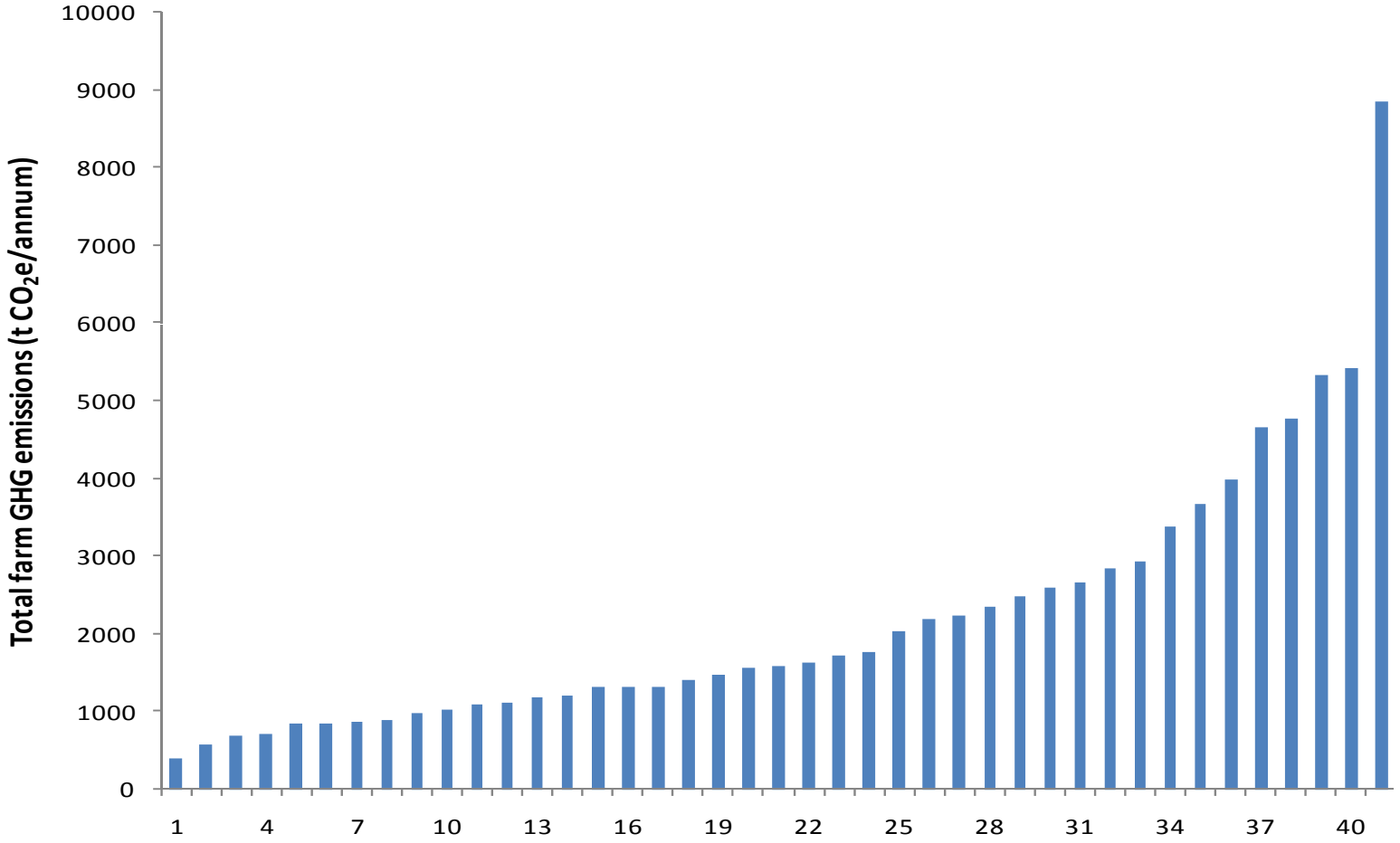
Estimating GHG emissions

- Dairy Greenhouse gas Abatement Strategies (DGAS) calculator
- Based on Australian and IPCC algorithms, emission factors and methodologies
- Estimates 4 sources of emissions (all converted to CO_2equivalents)
  - pre-farm embedded emissions;
  - carbon dioxide;
  - methane;
  - nitrous oxide.
- DGAS presents results as total farm GHG emissions (t CO_2e) and milk GHG emission intensity (t CO_2e/t milksolids)

Total farm and milk GHG emission intensity



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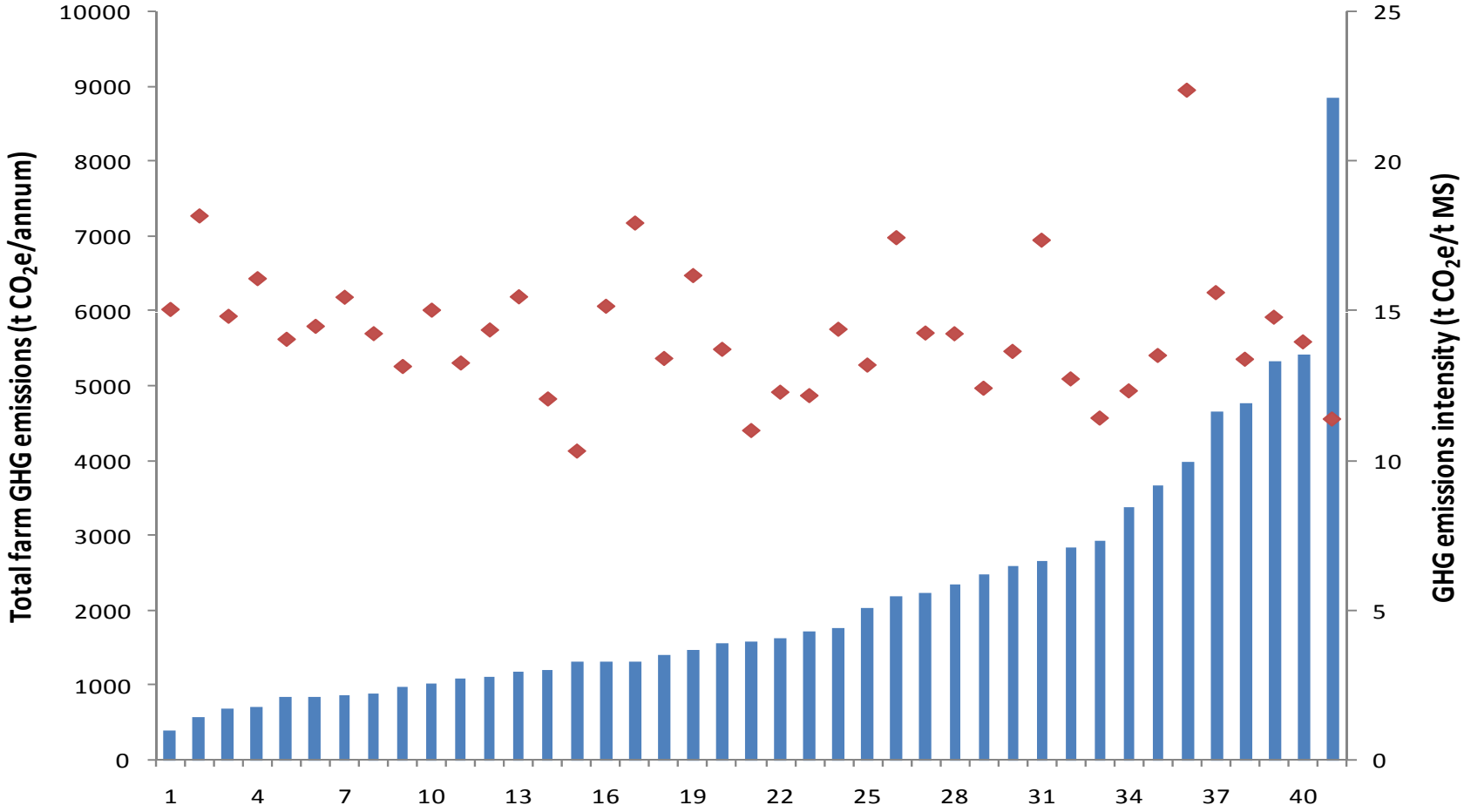
Total farm and milk GHG emission intensity



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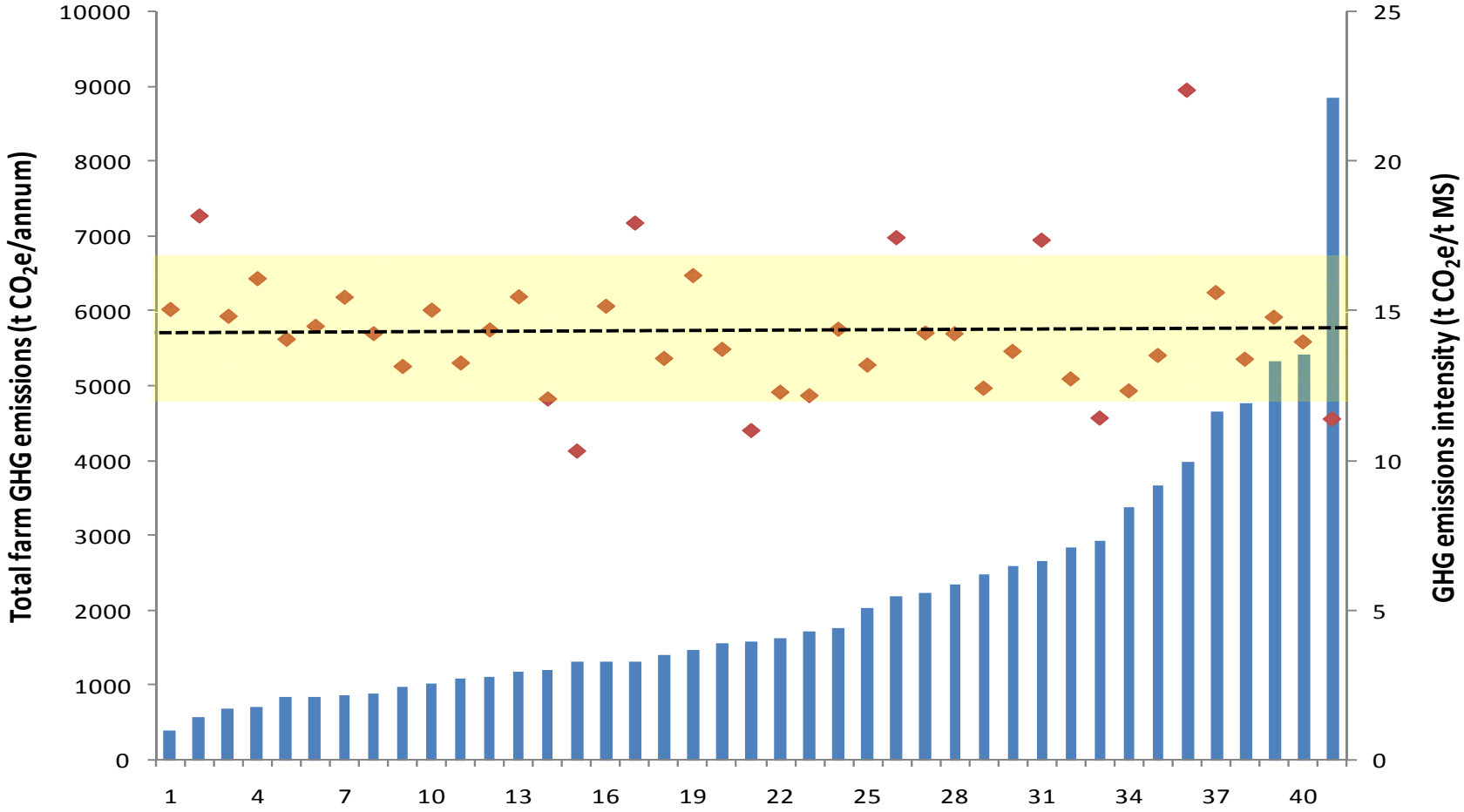
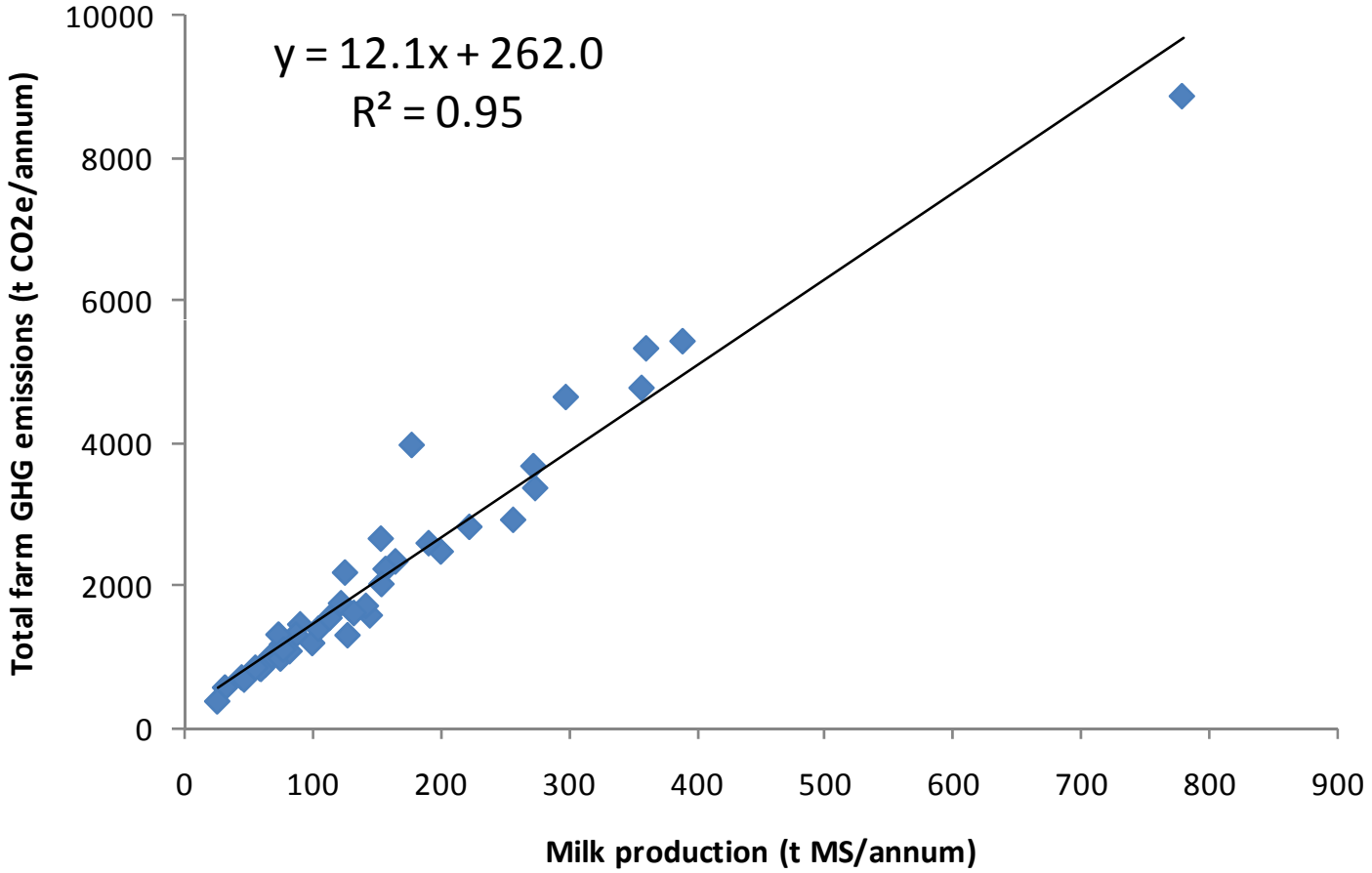
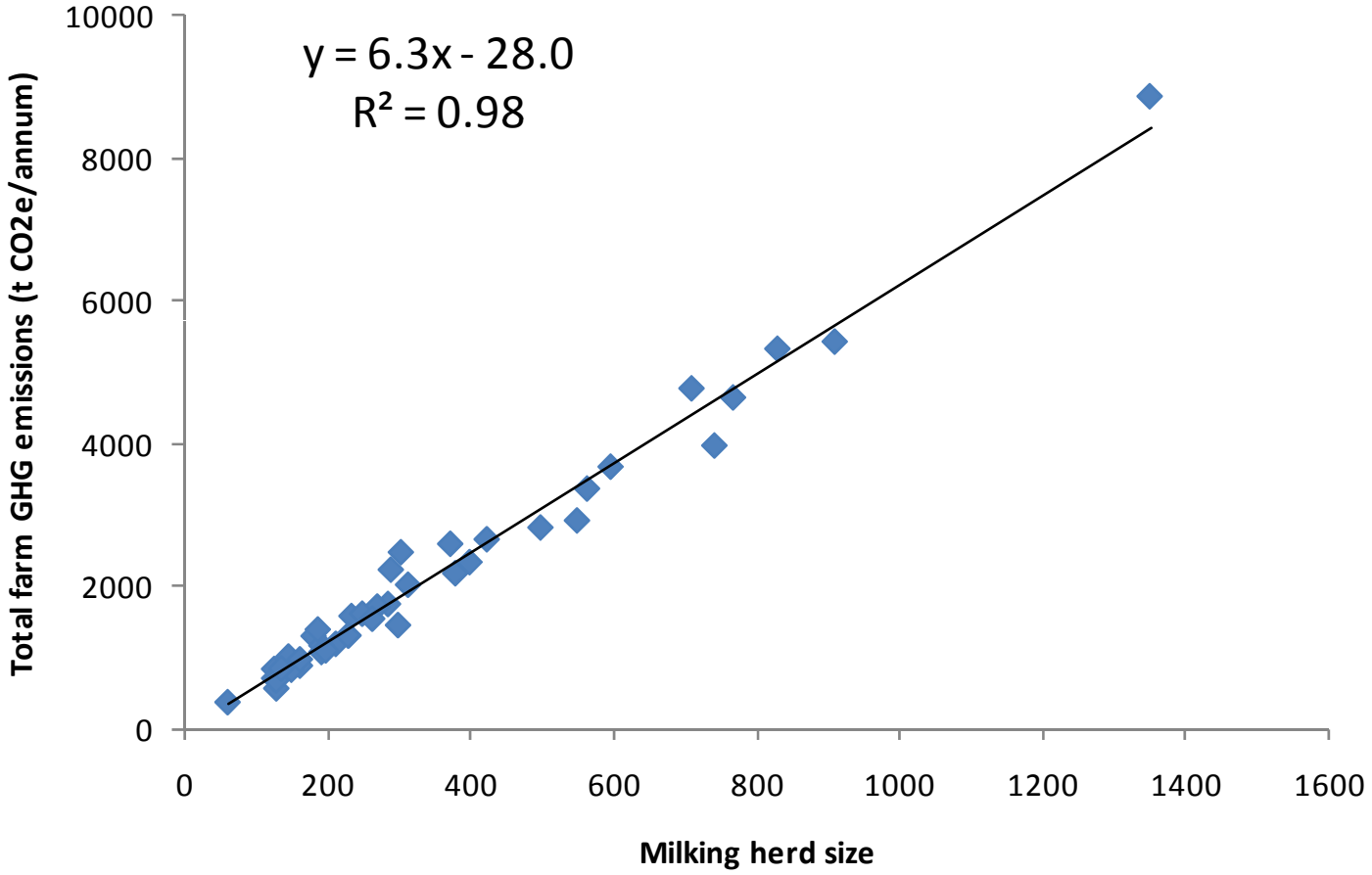
Total farm and milk GHG emission intensity



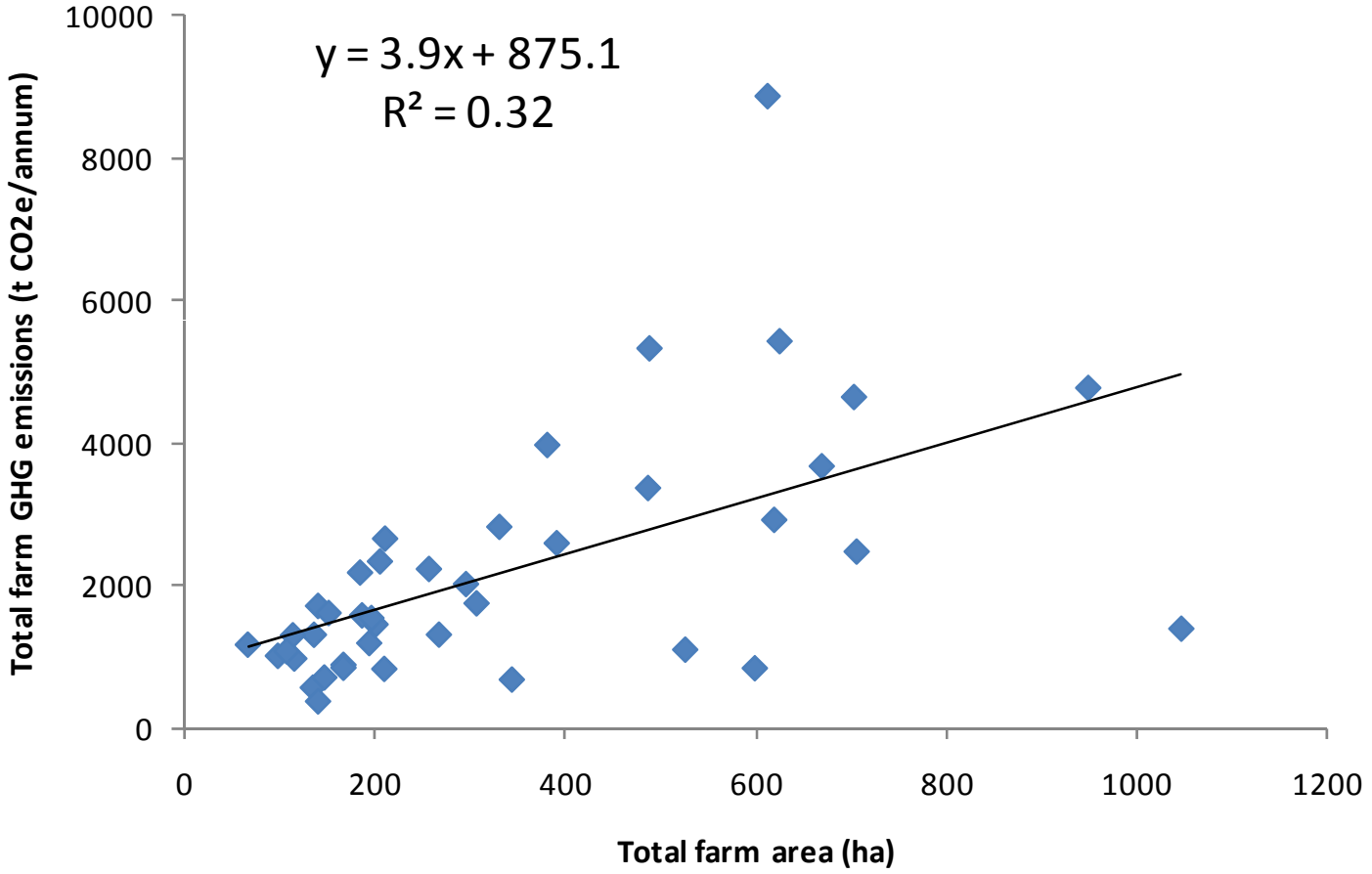
Milk GHG emission intensity



Cow GHG emission intensity



Area GHG emission intensity



Mean regional GHG emission intensity results

Region	Milk intensity (t CO_2e/t MS)	Cow intensity (t CO_2e/cow)	Area intensity (t CO_2e/ha)
NSW	14.4^{b}	6.5^{a}	5.8^{b}
QLD	14.8^{b}	5.8^{a}	4.4^{b}
SA	13.1^{b}	6.4^{a}	7.8^{ab}
TAS	17.8^{a}	5.9^{a}	10.9^{a}
Northern VIC	13.0^{b}	6.3^{a}	8.6^{ab}
South Eastern VIC	13.6^{b}	6.2^{a}	10.1^{a}
South Western VIC	13.2^{b}	5.9^{a}	6.5^{ab}
WA	14.5^{b}	6.1^{a}	5.2^{b}
Mean	14.3	6.2	7.5

Superscript letter which differ indicate a significant ($P<0.05$) difference in GHG emissions intensity

Influence of grain feeding on GHG emissions intensity

- Three grain feeding groups
  - Low: < 1 tonne DM/annum
  - Medium: 1 to 2 tonnes DM/annum
  - High: > 2 tonnes DM/annum
- 20 low grain feeding farms
- 18 medium grain feeding farms
- 3 high grain feeding farms
- Combined the medium and high grain feeding farms together

Influence of grain feeding on GHG emissions intensity

Grain feeding group	Milk intensity (t CO_2e/t MS)	Cow intensity (t CO_2e/cow)	Area intensity (t CO_2e/ha)
Low (< 1 t DM/cow.lactation)	15.3[a]	5.9[b]	8.6[a]
Med/high (> 1 t DM/cow.lactation)	13.4[b]	6.4[a]	6.5[a]
LSD (P=0.05)	1.3	0.4	n.s.

Superscript letter which differ indicate a significant (P<0.05) difference in GHG emissions intensity

Influence of farming system on GHG emissions intensity

- Dairy Australia defined farming system (FS) classification
- A4N dataset only represented 3 of the 4 FS groups

➢ FS1: low grain/purchased supplements and milk production per cow

➢ FS2: medium grain/purchased supplements and milk production per cow

➢ FS3: high grain/purchased supplements and milk production per cow with some mixed ration on a feedpad as required

- 19 FS1 farms, 13 FS2 farms and 9 FS3 farms

Influence of farming system on GHG emissions intensity

Farming system group	Milk intensity (t CO_2e/t MS)	Cow intensity (t CO_2e/cow)	Area intensity (t CO_2e/ha)
FS1	15.7[a]	5.7[a]	7.6[a]
FS2	13.1[b]	6.3[b]	7.6[a]
FS3	12.9[b]	7.0[c]	7.2[a]
LSD (P = 0.05) FS1 v FS2; FS1 v FS3; FS2 v FS3.	 1.3 1.5 n.s.	 0.4 0.4 0.5	 n.s. n.s. n.s.

Superscript letter which differ indicate a significant (P<0.05) difference in GHG emissions intensity

Concluding remarks

- Strong linear relationship between either milk production or milking herd size and total farm GHG emissions
- Increasing grain and/or farm intensity appears to assist in reducing milk GHG emissions intensity
- More farm data is required, especially with the most complex farming systems (feedlot dairies) to qualify this previous statement
- Will increasing farming intensity, to reduce GHG emissions intensity, be to the detriment of low cost/ pasture based farming systems that provides many regions of Australia with it international competitive advantage?

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