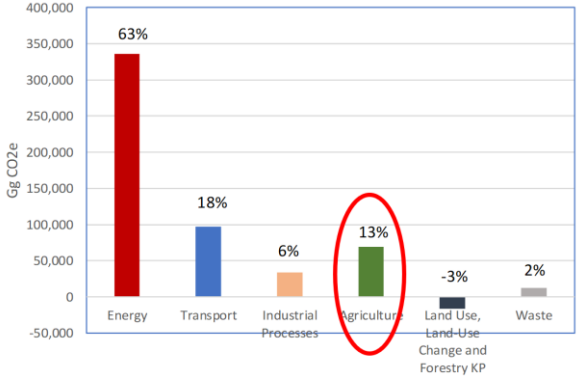
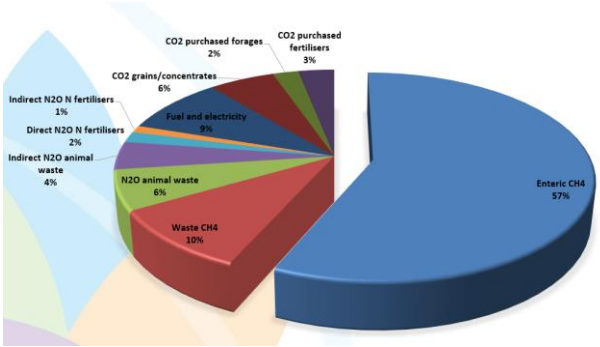
How do we estimate greenhouse gas emissions?

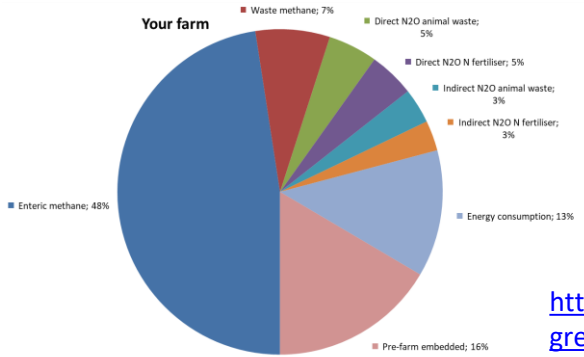




- Australian Federal Government estimates and reports GHG emissions every year to IPCC
- Calculated using the Australian National Greenhouse Gas Inventory (NGGI)
  - contains a series of equations and emission factors to estimate GHG emissions
  - methane and nitrous oxide reported in Agriculture,
  - electricity and fuel reported in Energy,
  - tree and soil carbon sequestration reported in Land Use Change.
- Developed the DGAS/ ADCC calculator to bring together pre-farm (embedded emissions), on-farm methane and nitrous oxide and energy consumption into the one tool

Dairy greenhouse gas emissions

		Milking Cows	Heifers >1	Heifers <1	Mature bulls	Immature bulls	
Livestock numbers		250	75	75	25	15	head
Liveweight		500	350	150	600	200	kg/head
Liveweight gain			0.7	0.7		0.7	kg/day
Milk production							
	Select option for milk production	litres per herd per annum		Amount of milk produced		1,200,000	litres of milk
	Average annual milk fat (%)	4.2	%	Average annual milk protein (%)		3.2	%
	Average lactation length (days)	300	days	verage milk production (litres/cow per da		16.0	
Milkers average annual diet intakes and quality		**Intake (kg DM/day)**		**Dry matter digestibility (DMD; %)**		**Crude protein (CP; %)**	
	Pastures	14.0		75.0		20.0	
Estimated intake based	Concentrates/ grain	2.5		85.0		12.0	
on data entry	Silage	1.5		70.0		16.5	
14.7 kg DM/cow.day	Hay						
	By-products						
Click here for help with feed quality	Other						
	Total (kg DM/day) or average (%)	18.0		76.0		18.6	
Average annual dry matter digestibility (DMD) for all other stock (%)		75.0	%				
Average annual crude protein (CP) for all other stock (%)		20.0	%				
Fertilisers							
	How do you which to enter the fertiliser rates?		tonnes of element per annum			Click here to work out fertiliser rates	
	Area of N fertiliser (ha)				**Rate of N fert.**		
Area of pastures fertilised with N (ha)			ha	Rate of N applied to pastures	46	t per annum	
Area of crops fertilised with N (ha)			ha	Rate of N applied to crops		t per annum	

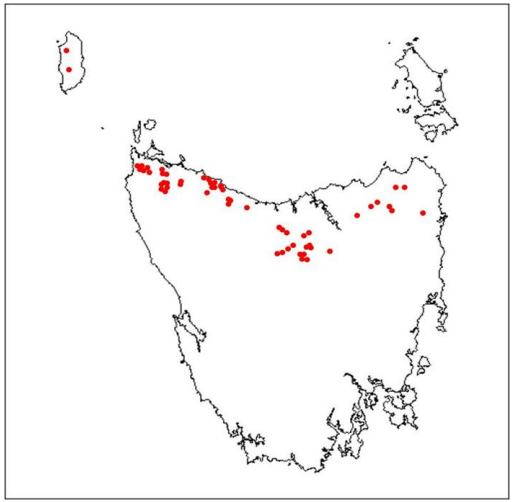


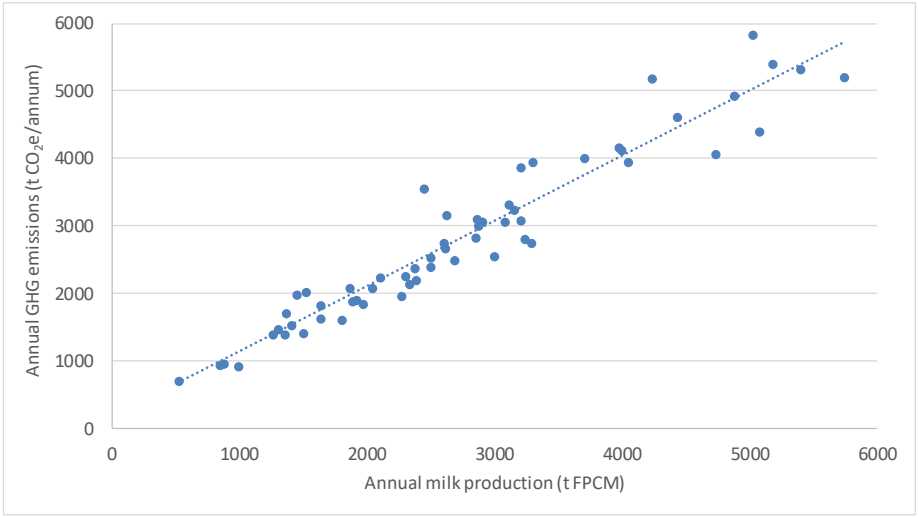
- Herd numbers, liveweights, liveweight gain (young stock)
- Milk production
- Diet quantity and quality
- Fertiliser inputs, especially N
- Electricity and diesel consumption
- Purchased supplements
- Manure management (default or user defined)
- Carbon sequestration in trees (static approximate)

https://www.dairyingfortomorrow.com.au/tools-and-guidelines/dairy-greenhouse-gas-abatement-calculator/

Dairy greenhouse gas emissions

TM60 dataset

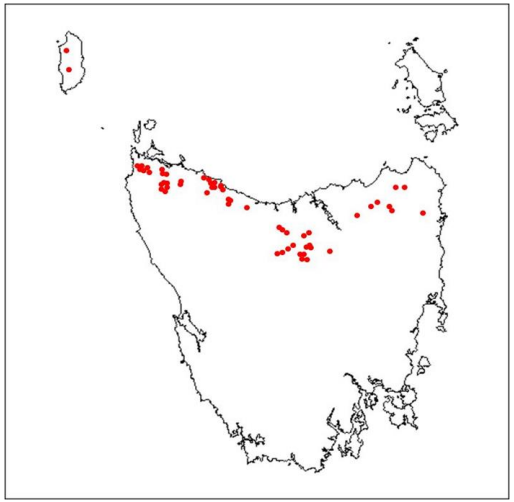




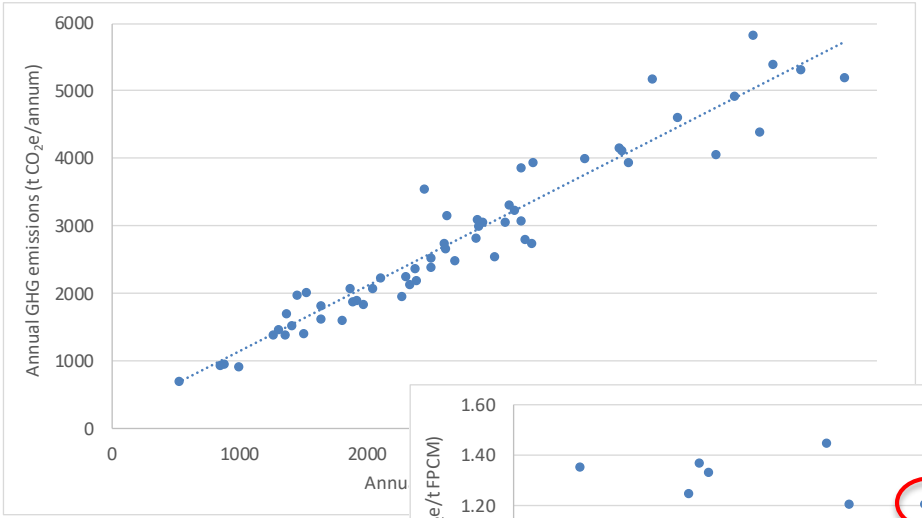
Christie et al. (2011)

Dairy greenhouse gas emissions

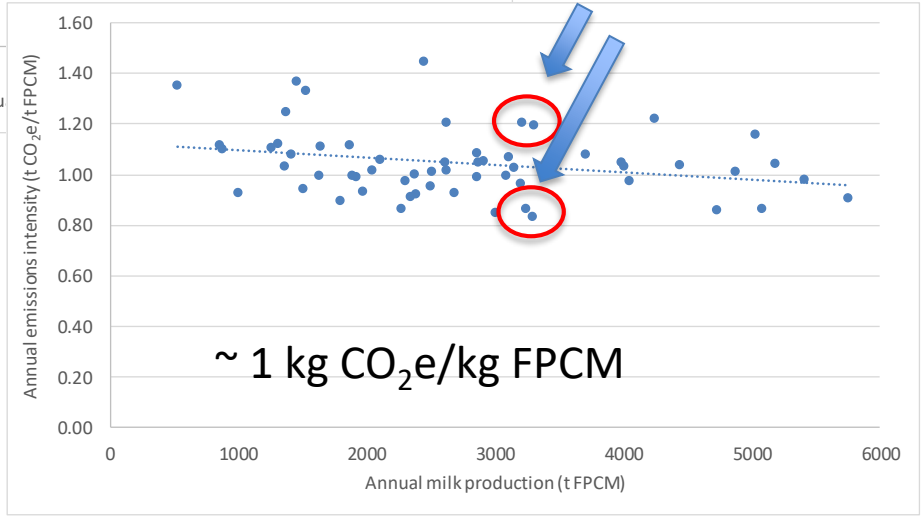
TM60 dataset



Christie et al. (2011)

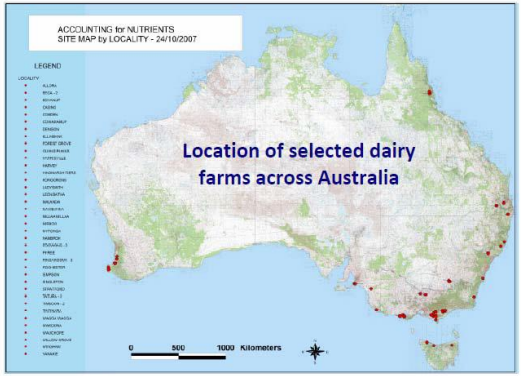


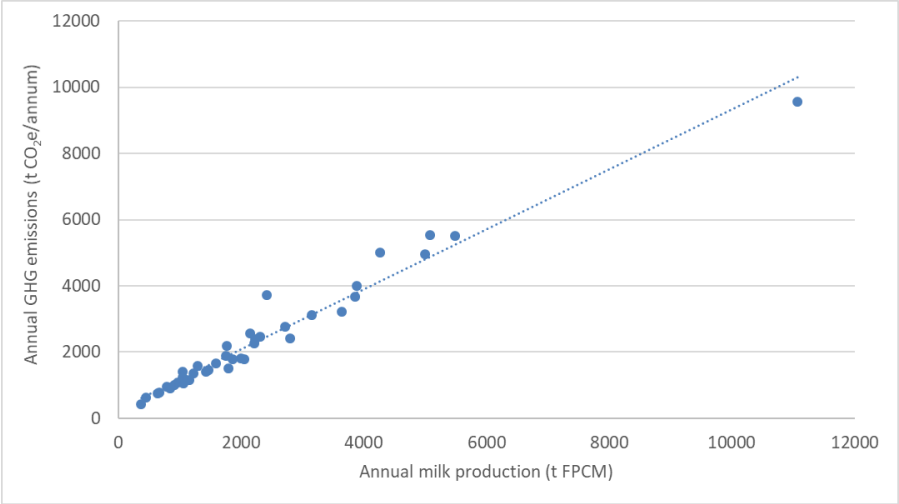
Similar production but emissions intensity varied from 0.8 to 1.2 kg CO_2e/kg FPCM



Dairy greenhouse gas emissions

A4N dataset





Christie et al. (2012; 2018)

Dairy greenhouse gas emissions

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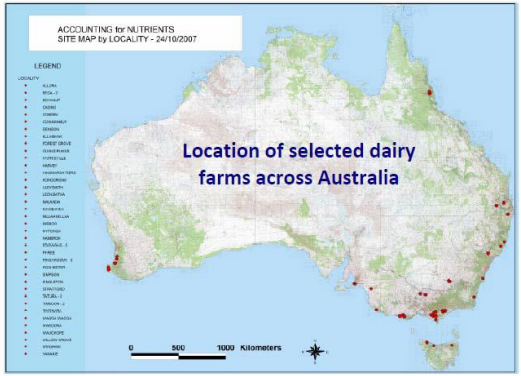

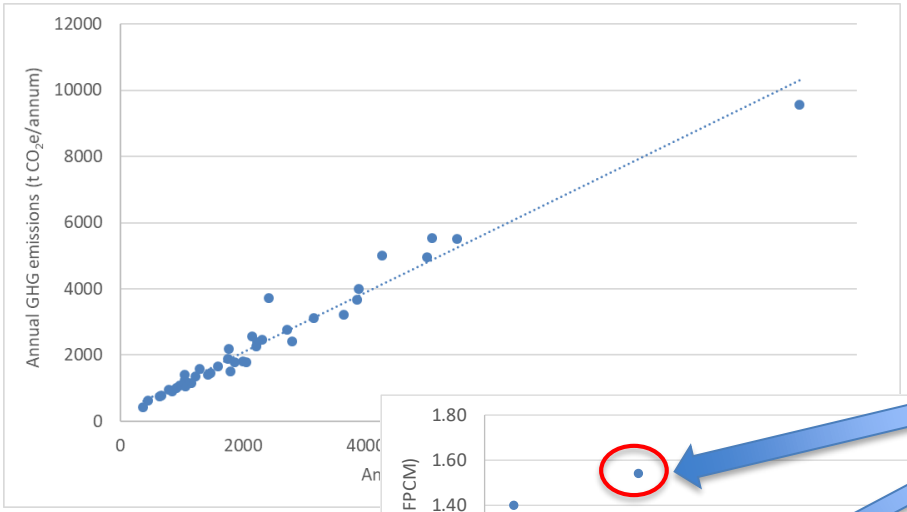

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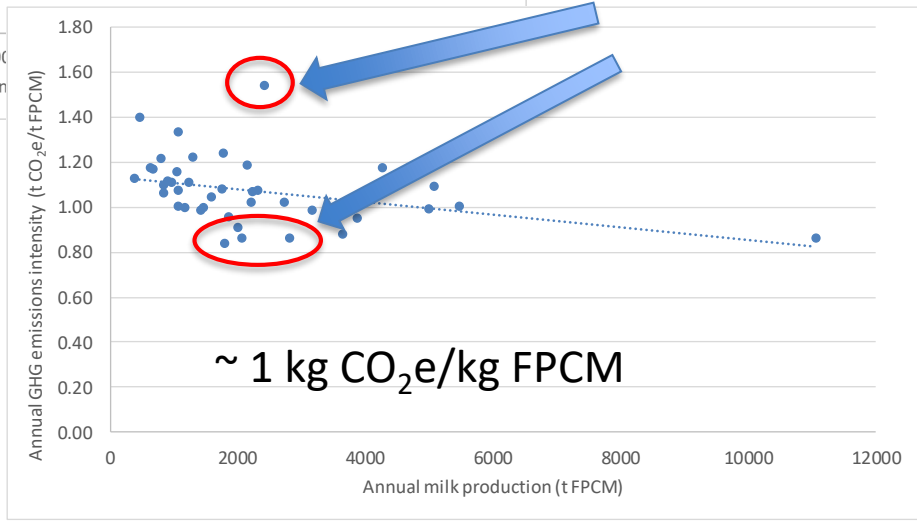

Christie et al. (2012; 2018)

Dairy greenhouse gas emissions

- NGGI methodology is updated as new science emerges
- We have a range of tools to estimate dairy GHG emissions (all based on national inventory methodology)
  - DGAS/ADCC (DairyingforTomorrow website)
  - DairyBase/ Dairy Farm Monitor Project
- Estimate tree and soil carbon sequestration, we need to use FullCAM
- There currently appears to be a lower limit of around 0.8 kg CO_2e/kg FPCM
  - Need new science to help us reduce this further
  - Need carbon sequestration to offset the balance

Carbon Neutral Accounting

- Greenhouse Gas emissions
  - DGAS/ADCC
  - Consistent with national inventory
- Carbon stocks and fluxes
  - FullCam
    - Soil carbon
    - Vegetation carbon
  - **Note – only fluxes count!**

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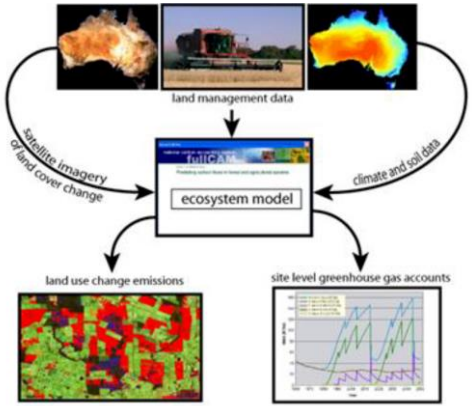

ADCC/DGAS can be found at https://www.dairyingfortomorrow.com.au/tools-and-guidelines/dairy-greenhouse-gas-abatement-calculator

FullCAM can be found at https://publications.industry.gov.au/publications/climate-change/climate-change/climate-science-data/greenhouse-gas-measurement/land-sector.html