The science in a farming systems context

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The Primary Industries Climate Challenges Centre (PICCC) is a joint venture between

THE UNIVERSITY OF MELBOURNE

AGRICULTURE VICTORIA

Why a farm systems context?

- Considers the complex interactions between
  - Climate, soil, plant, animal and management
  - Within a whole production system
- Considers wider impacts
  - Potential unanticipated impacts
- Includes biophysical and economic
  - The value-proposition

Farm Systems Context

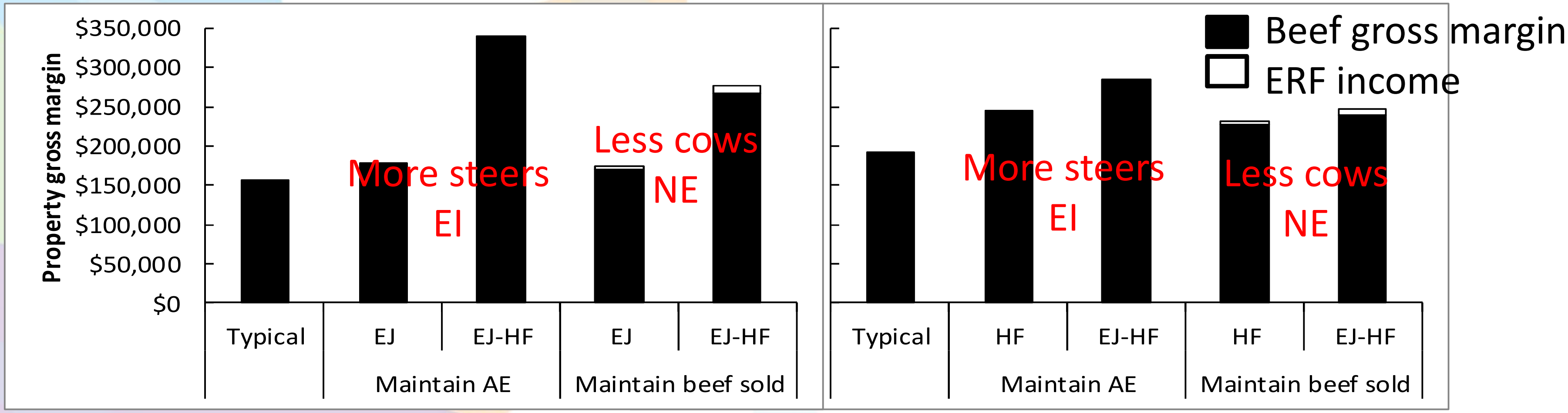
- Whole farm systems analysis of GHG abatement options (WFSAM)
  - Farm systems analysis in support of
    - NANORP and NLMP
      - Modelled promising emerging options
      - Beef, dairy, wool, prime lamb systems
  - Evaluated both:
    - Net emissions reductions (CFI/ERF)
    - Emissions intensity improvements (Carbon Footprint/ERF)
  - Over 30 case studies available

Slide 3

RE3 how primary industries are developing and adopting strategies to reduce nitrous oxide, carbon and methane emissions
what this means for productivity, emissions and emissions intensity within a farming systems context.
Drawing on the science from NSCP, NLMP and the NANORP
15 minute presentation
Richard Eckard, 15/04/2016

Emissions Management
Efficient Northern Beef Systems

- Longreach & Boulia case studies
  – Early joining & high fertility
    - 58% weaning to 74% weaning
    - Mated at 1 or 2 years
- EI more profitable than NE
  – Emission intensity
    - $110K – $183K more than typical
  – Net reductions
    - Offset income 9 to 15% of GM
  – Informed the Herd Method



WFSAM: Cullen *et al.* (2016)

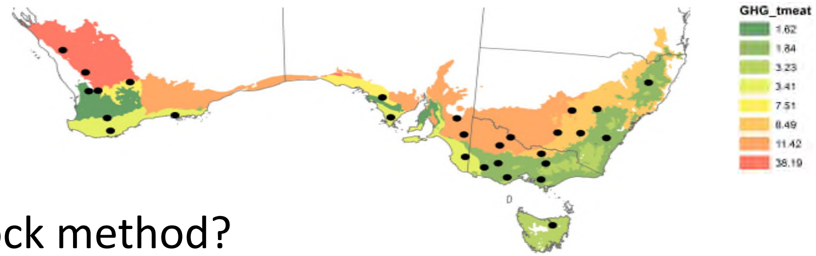
Emissions Management
Feeding nitrates in northern beef systems

Herd	GHG emissions (t CO_2-e)	Gross margin after interest ($)	Difference from typical
Typical [A]	3,341	$157 K	
Typical + Nitrates [B]	3,165	$161 K	$4 K (B-A)
Early joining and high fertility [C]	3,342	$340 K	$183 K (C-A)
Early joining and high fertility + Nitrates [D]	3,103	$346 K	$188 K (D-A)

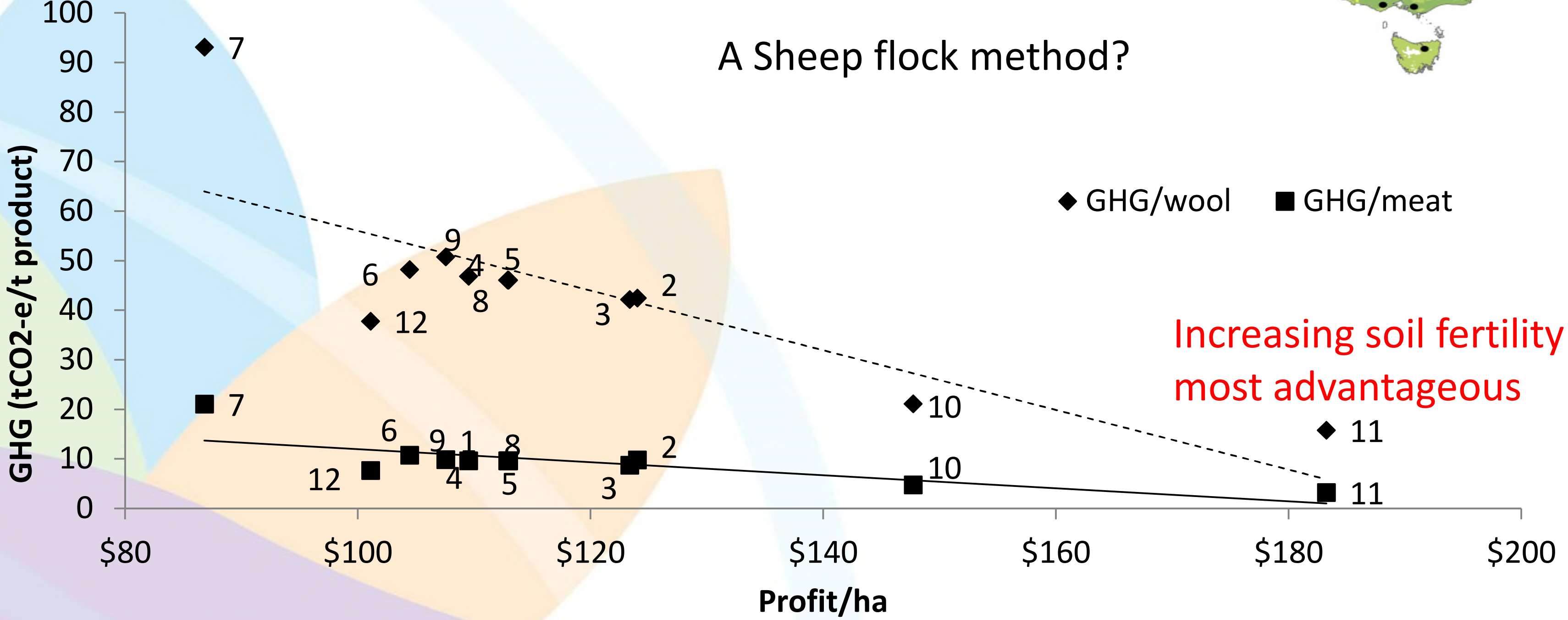
Longreach: 23,000 ha with 1,750 AE
Boulia: 81,760 ha with 1,842 AE

WFSAM: Harrison *et al.* (2015)

Emissions management
Combining efficiency options - Sheep



A Sheep flock method?



Increasing soil fertility most advantageous

WFSAM: Harrison *et al.* 2015

Emissions case studies
Leucaena in Northern Beef Systems

- Data from NLMP
- Leucaena
  - 21% less CH_4, but more N_2O
- Most profitable
  - Reduce EI not NE
- Options to reduce both

	Rhodes	Leucaena		
	Baseline	equal AE	equal LW	equal GHG
AE	400	**400**	369	483
LWT	75	81	**75**	98
ERF @ $23/t CO_2e		$2.9K	$4.0K	
ERF @ $10/t CO_2e		$1.3K	$1.8K	
Gross margin ($)	$80K	$93K	$87K	$109K
Net emissions (t CO_2-e/farm)	738	610	563	**738**
Emissions intensity (t CO_2-e/t LW sold)	9.8	7.5	7.5	7.5

WFSAM: Harrison *et al.* (2015)

Emissions management
Lotus in southern sheep systems

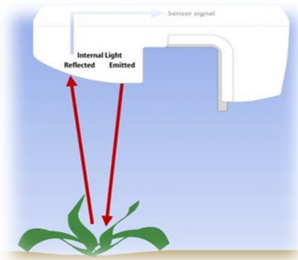
- Profitable for prime lamb
  - Less so for wool
- Reduce both
  - NE =19%
  - EI = 20%

40% Lotus	Units	Wool		Prime Lamb	
		Avg	Top	Avg	Top
\$6/t CO_2e	\$/ha	2.08	2.29	2.45	2.91
\$24/t CO_2e	\$/ha	8.39	9.22	9.88	11.71
Increased wool	\$/ha	17.67	22.89	8.88	12.96
Increased LWG	\$/ha	6.01	7.09	30.05	37.95
CH_4 reduction	t CO_2e/ha	2.5K	2.6K	1.2K	2.4K
Emission Intensity	t CO_2e/t product	19.6	22.7	8.8	10.0

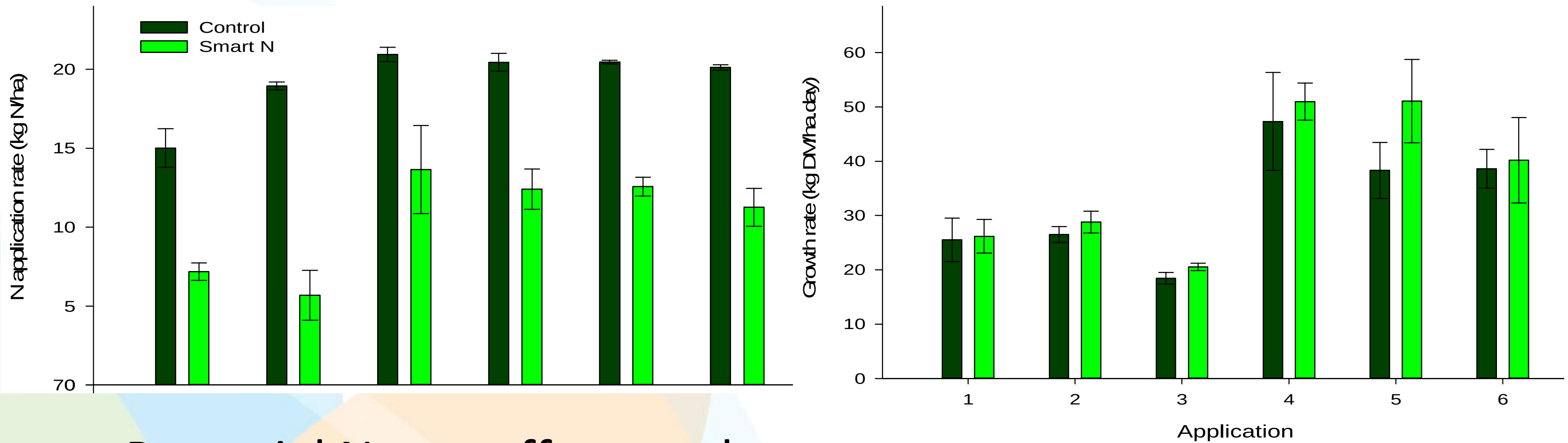
WFSAM: Doran-Browne *et al.* (2016)

Emissions management
Smart-N in dairy

Using the Smart-N™ Greenseeker® ™ to reduce N fertiliser and avoid urine patches



Emissions management
Smart-N in dairy



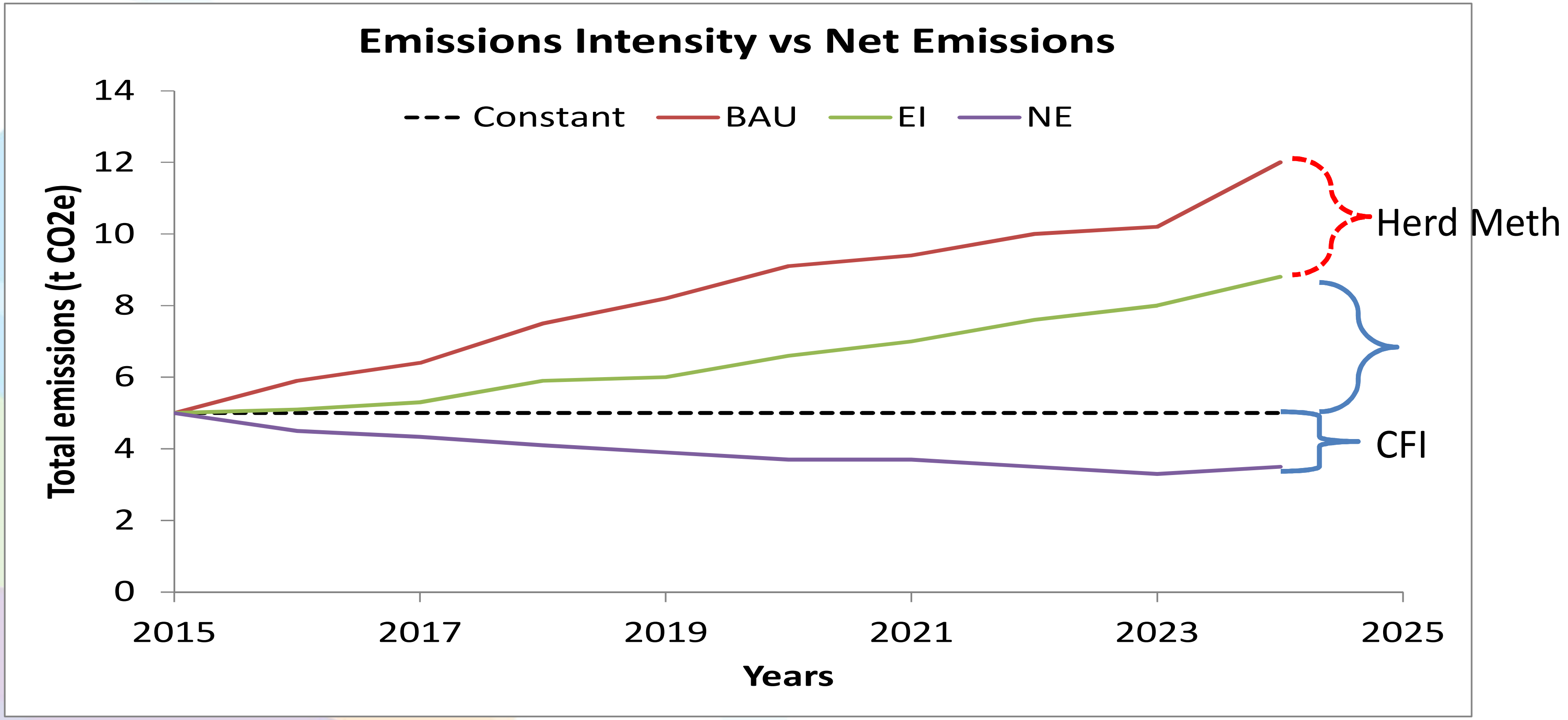
- Potential N rate offset method (e.g. Cotton method)
  - 16% reduction in N fertiliser (direct N2O)
  - 17% less nitrate leaching (indirect N2O)
  - 13% less N volatilisation (indirect N2O)

WFSAM: Rawnsley *et al.* (2016)

What is it worth to a farmer?

- Focus on EI and profit
  - $39/ha - wool
  - $250/ha - prime lamb
  - $111/ha - beef
  - $115/ha - dairy
- Offset income range
  - $0 to $15/ha

A focus on the footprint
EI versus NE



WFSAM: Eckard *et al.* (2016)

EI & Supply chain demands

- Mondelez
  - 15% less operational GHG EI from 2010 to 2015
- Fonterra
  - 30 % less GHG EI / litre milk sourced and processed in New Zealand by 2030
- Olam
  - 10% less GHG EI by 2020
- Unilever
  - 50% less GHG EI across the lifecycle by 2020
- Cargill
  - 5% less GHG EI by 2020 compared to 2015
- Kellogg Company
  - 15% less GHG EI by 2020
- Pfizer
  - 20% less GHG EI by 2020 (60 to 80% by 2050)
- Wilmar international
  - 89.72% less GHG from 2013 to 2020
- Nestle
  - 35% less GHG EI on 2005 baseline
- SAB Miller
  - 25% reduction kgCO2e/hl lager (against 2010 baseline)

Note the focus on Emission Intensity (GHG EI) - The carbon footprint

Adaptation vs mitigation

- Focusing on emissions intensity
  - May not help national emissions target
    - Over time agriculture becomes a larger %
  - Could lead to intensification
    - Less resilient in future climates
- Balancing production systems to the region
  - Intensify (EI) where water is secure
  - Diversify (NE) where climate is more variable

In Summary

- Next steps in offsets => Systems methods
  - Emissions + sequestration
  - Including rangeland/pasture restoration
- Reducing net emissions
  - Options exist (e.g. nitrate, oils, legumes)
  - Some profitable with aggregation
    - Economies of scale are needed
- Reducing emissions intensity
  - Many options exist and most profitable
    - Greater chance of adoption
  - Can now comply with ERF (e.g. herd method)
  - Aligns with the supply chain
    - Reducing the carbon footprint