

Useful performance indicators to improve nitrogen management for dairy production



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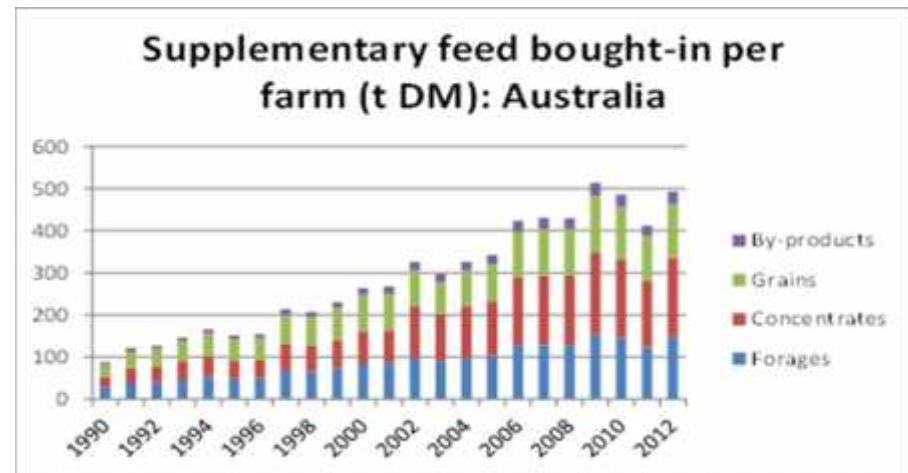
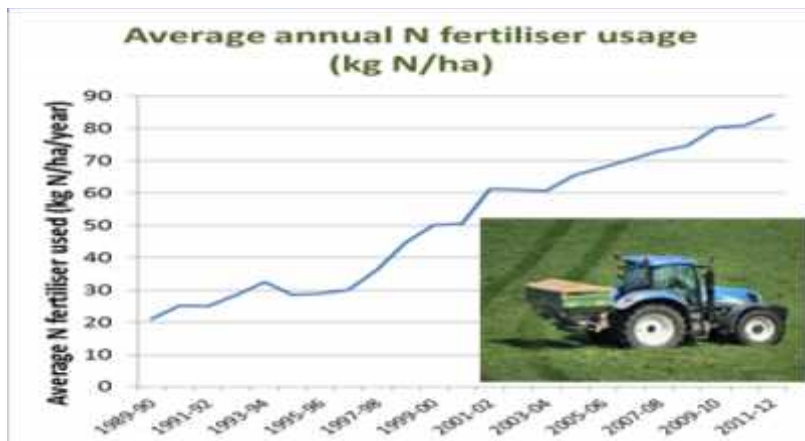
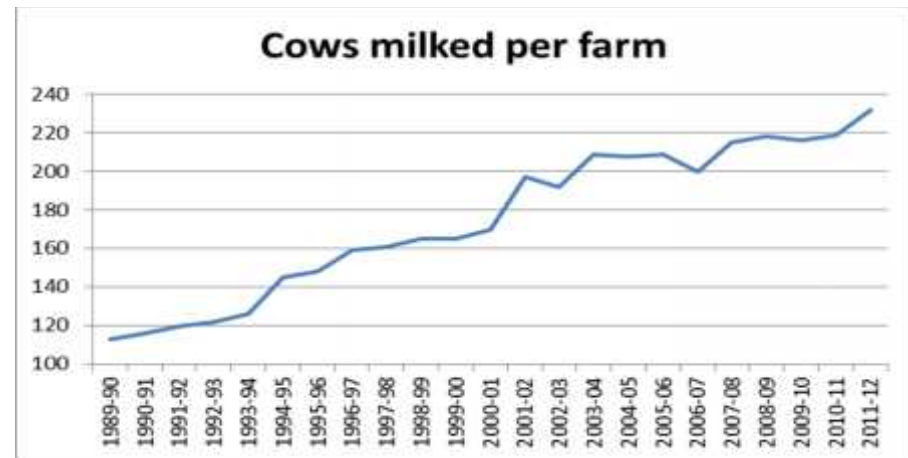
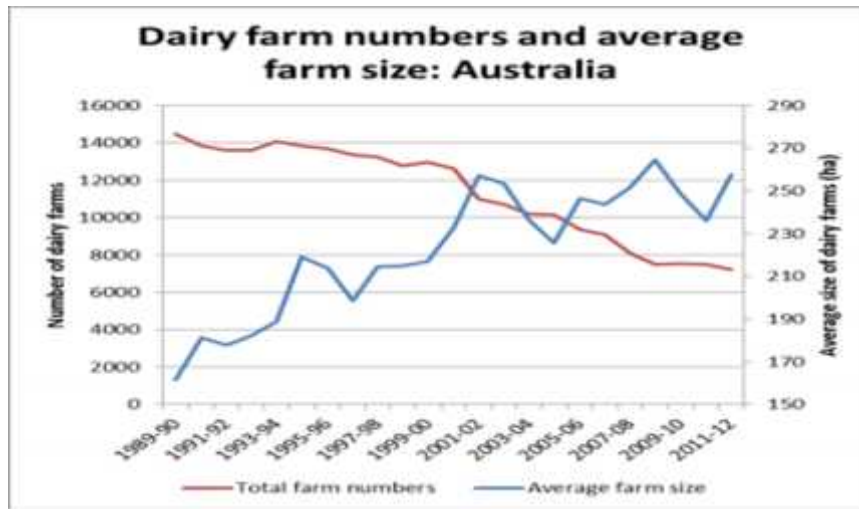


Increasing global demand and changing supply of milk

- Global milk production increasing ~5% pa over the past 50 years
currently ~800 b litres
- Australian dairy farms produce ~ 10 b litres
~ 10% world milk trade
- AUD\$13 billion - farm, manufacturing and export industry
Employs nearly 40,000 Australians on farms and in factories
- Changing nature of dairy production...globally and locally



Australian Dairy Production base





Range of dairy production systems

- 50% of the milk from 15% of the farms



Manure deposition and management

- Annually ~10 million m³ captured, separated, stored,
- and regularly applied

~ 6 x Volume of MCG each year

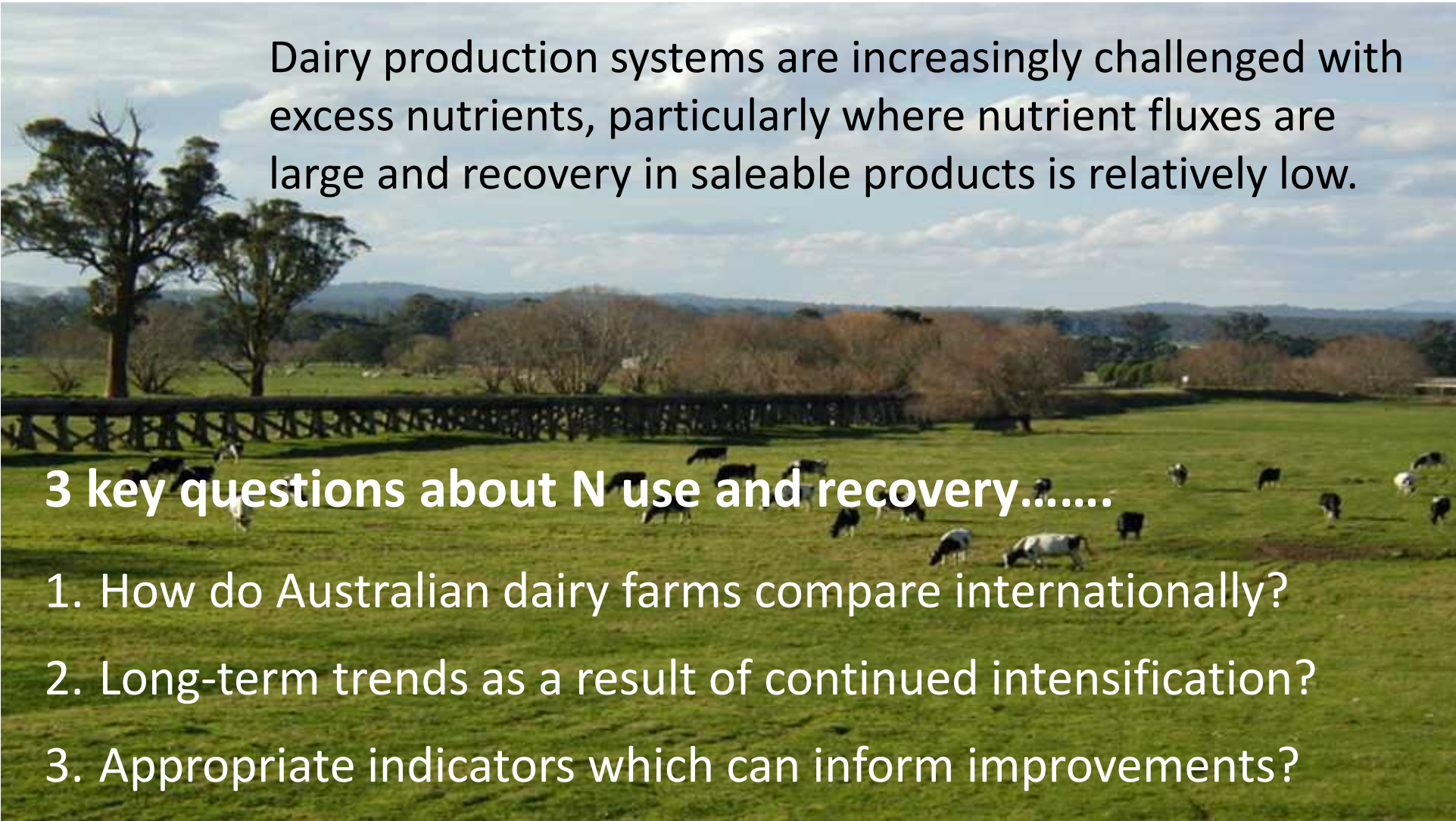
MCG volume = 1.6 M m³



Australia's 2 M dairy cows

- Produce ~10 b litres milk
- Excrete ~50 million m³ manure





Dairy production systems are increasingly challenged with excess nutrients, particularly where nutrient fluxes are large and recovery in saleable products is relatively low.

3 key questions about N use and recovery.....

1. How do Australian dairy farms compare internationally?
2. Long-term trends as a result of continued intensification?
3. Appropriate indicators which can inform improvements?

Commonly used farm-scale N indicators

- N Use Efficiency: Agricultural N output per unit N input (kg N / kg N expressed as a percentage)
- N Balance per unit area (kg N / ha)
- Production N Balance (i.e. g N / l milk)
 - akin to partial productivity used in production economics

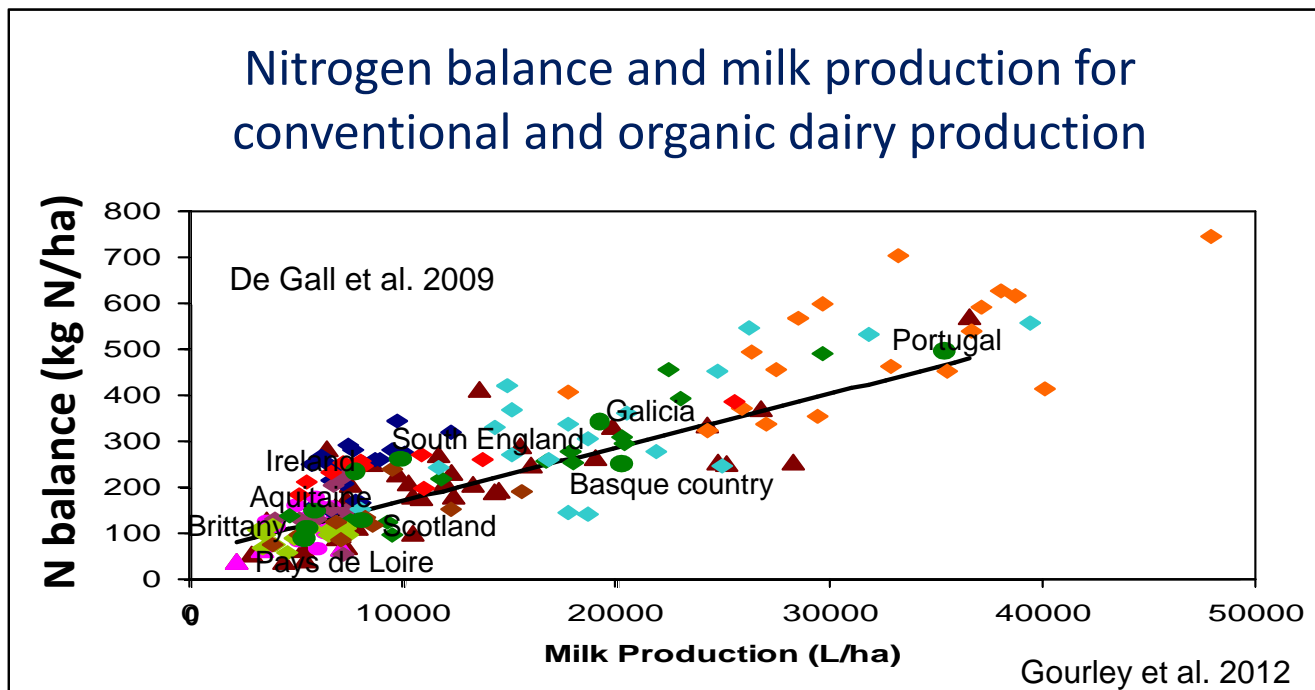


Quantifying N efficiency and balance in dairy production

- Whole-farm nitrogen budget
- Importance of N flows and transformations



1. How does the diversity of Australian dairy production compare with international systems?



2. What are the long-term trends as a result of continued intensification?

	Farm and herd details	N Imports	N Exports
ABARES	Number of dairy farms	Replacement milkers	Culls
ABS	Average farm size	Supplements used (concentrates, grains, forages, by-products)	Calves sold
DA	Effective land grazed (contact area)	N Fertiliser used	Milk produced
	Average herd size	Legume content of pasture	Milk solids

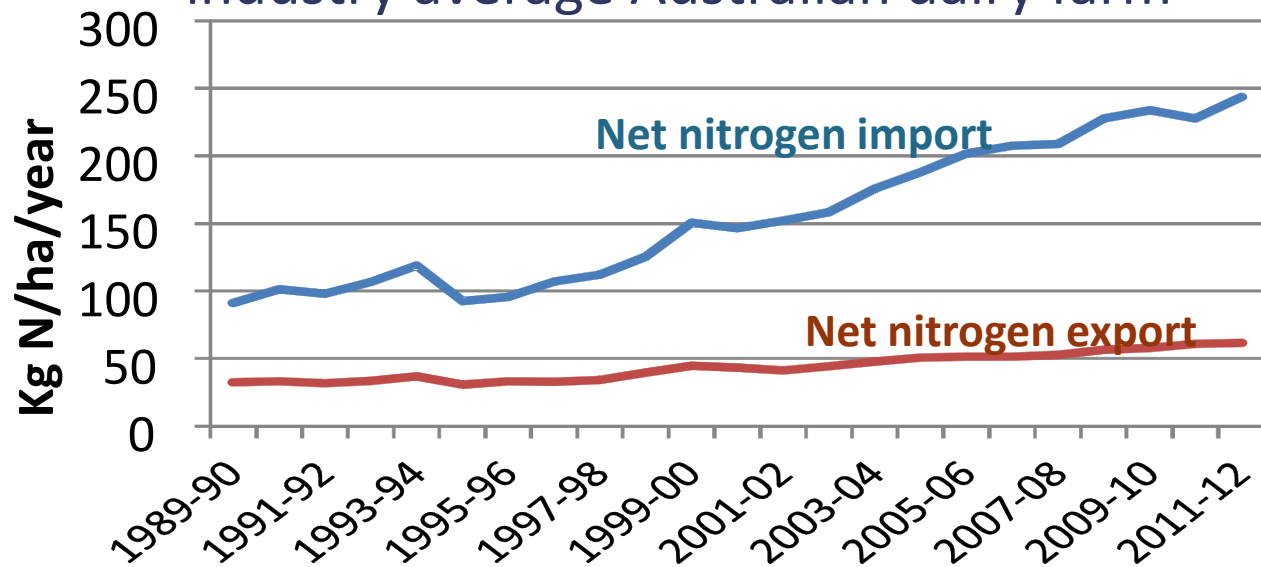
1990



2012

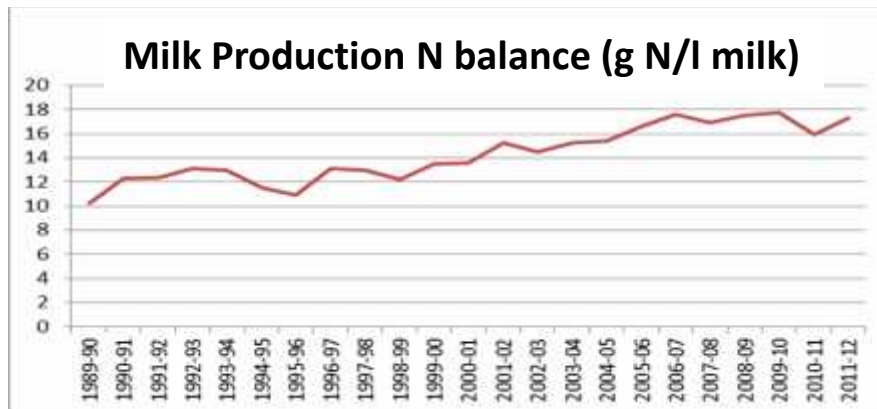
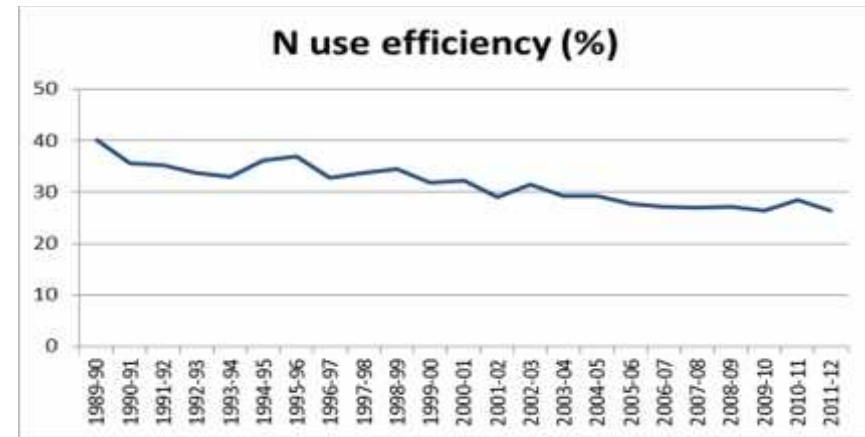
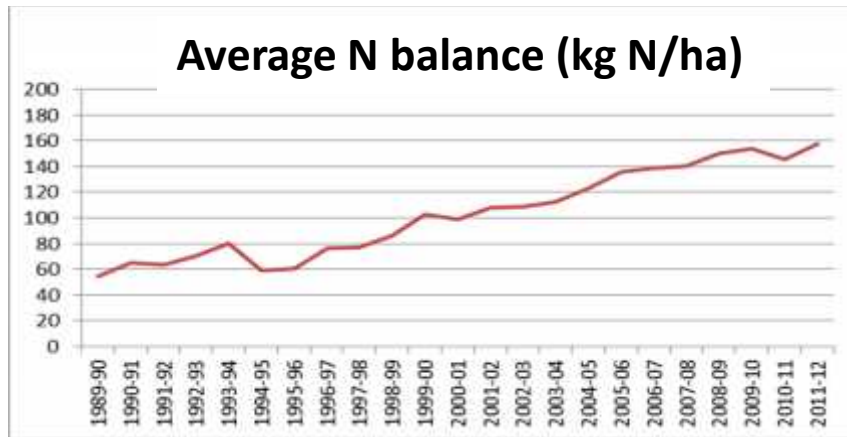
2. What are the long-term trends as a result of continued intensification?

Net nitrogen imports and exports (kg N/ha) for an industry average Australian dairy farm

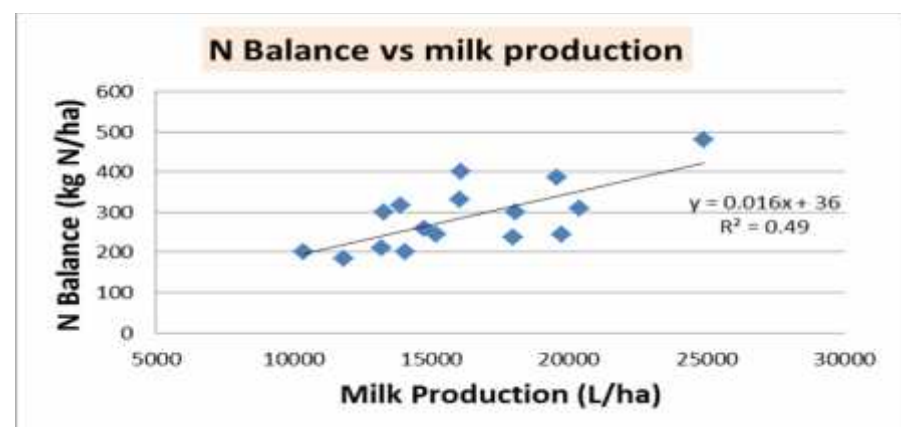
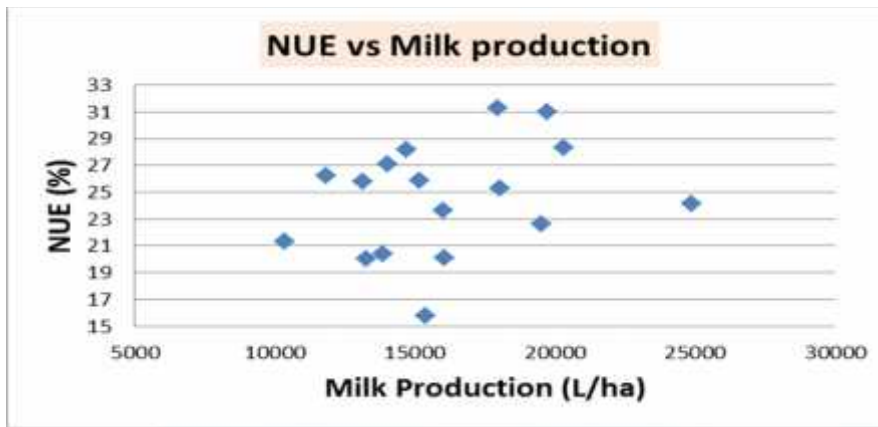


Stott and Gourley 2016

N recovery for Australian dairy production between 1990 and 2012.



3. What are the appropriate metrics which can be used to inform necessary improvements?



16 pasture-based dairy farms in Victoria

- 2014/15 production year



Underlying causes of declining N recovery

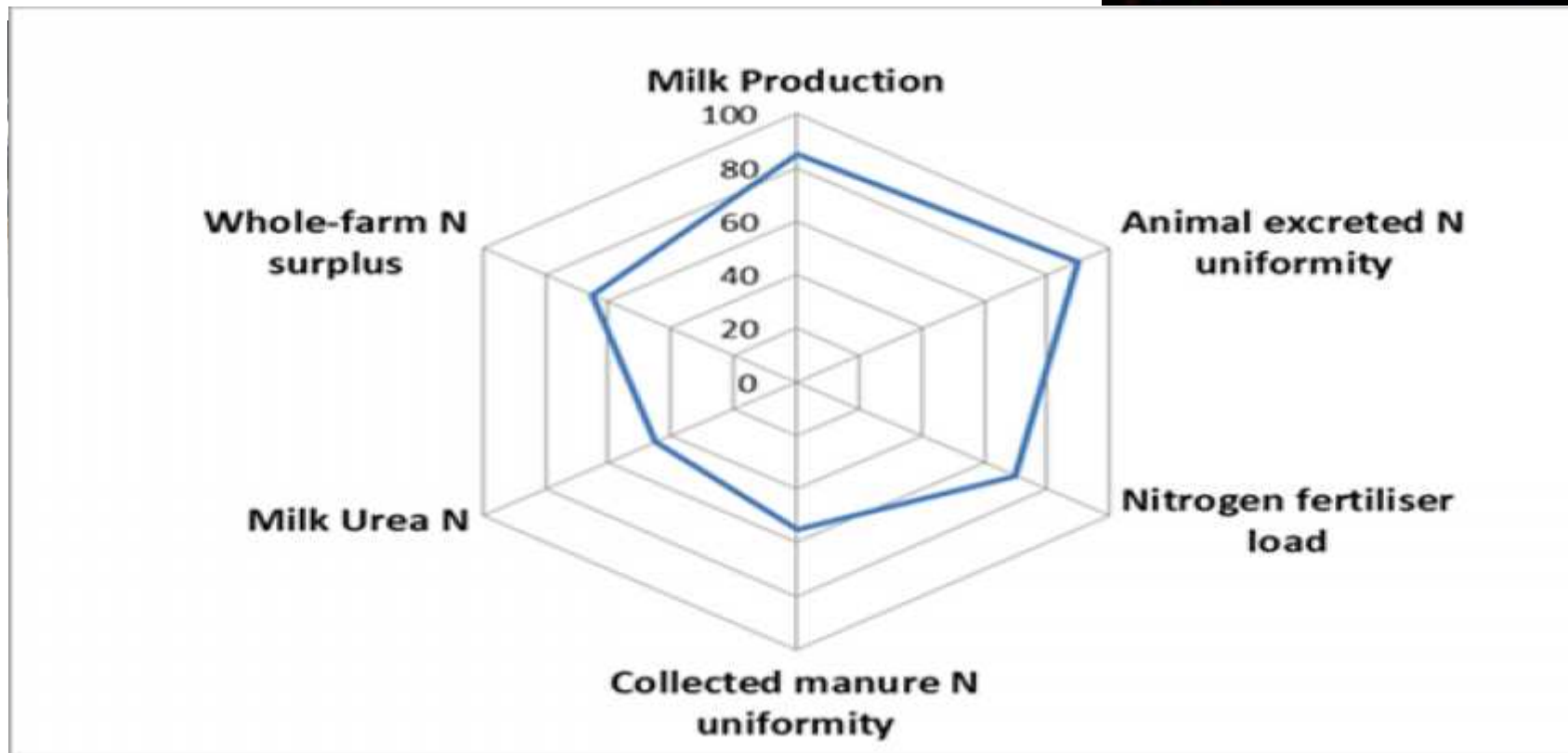
1. Increasing reliance on imported feed
2. Increasing N fertiliser input
3. Excessive dietary N intake
 - High excreta N loads
4. Increasing time off pasture
 - Lack of manure collection
 - Heterogeneous excreted nitrogen distribution



No one number can convey this complexity



Key points of intervention



Conclusions

- 1. Australian dairy farms vary widely - N use, balance & efficiency:**
but representative of dairy systems world-wide.
- 2. Industry intensification:** - continuing decline in N recovery.
 - NUE, Whole-farm N balance and N balance/milk production
- Useful industry-wide indicators to reduce N emissions.
- 3. Individual farms:** - 'Whole-farm' N Balance is most useful.
 - Further component-based N indicators are needed
 - Provide insights into potential points of intervention
 - Standardisation and appropriate bench-marking of industry and farm indicators is important.

