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Farm-level economics and NZ nitrogen leaching policy: best friends or unhappy marriage?

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Paper presented at the 2013 NZARES Conference
Lincoln University – Canterbury, New Zealand. August 28-30, 2013

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Farm-level economics and NZ nitrogen leaching policy: best friends or unhappy marriage?

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Introduction

- Agricultural intensification implicated with water quality decline
- On-farm economics and nutrient policy are linked:
 - ❖ Need for policy?
 - ❖ Cost of policy?
- How are they related in the context of nitrogen leaching in New Zealand?
- One of important issues facing NZ dairy industry



What is the problem?



Dairy industry is important to NZ

- Exports of \$14.6 billion in 2012
- 25% of merchandise export earnings
- Third of world's dairy trade
- Employment of ~45,000 people



North Island

VS

South Island

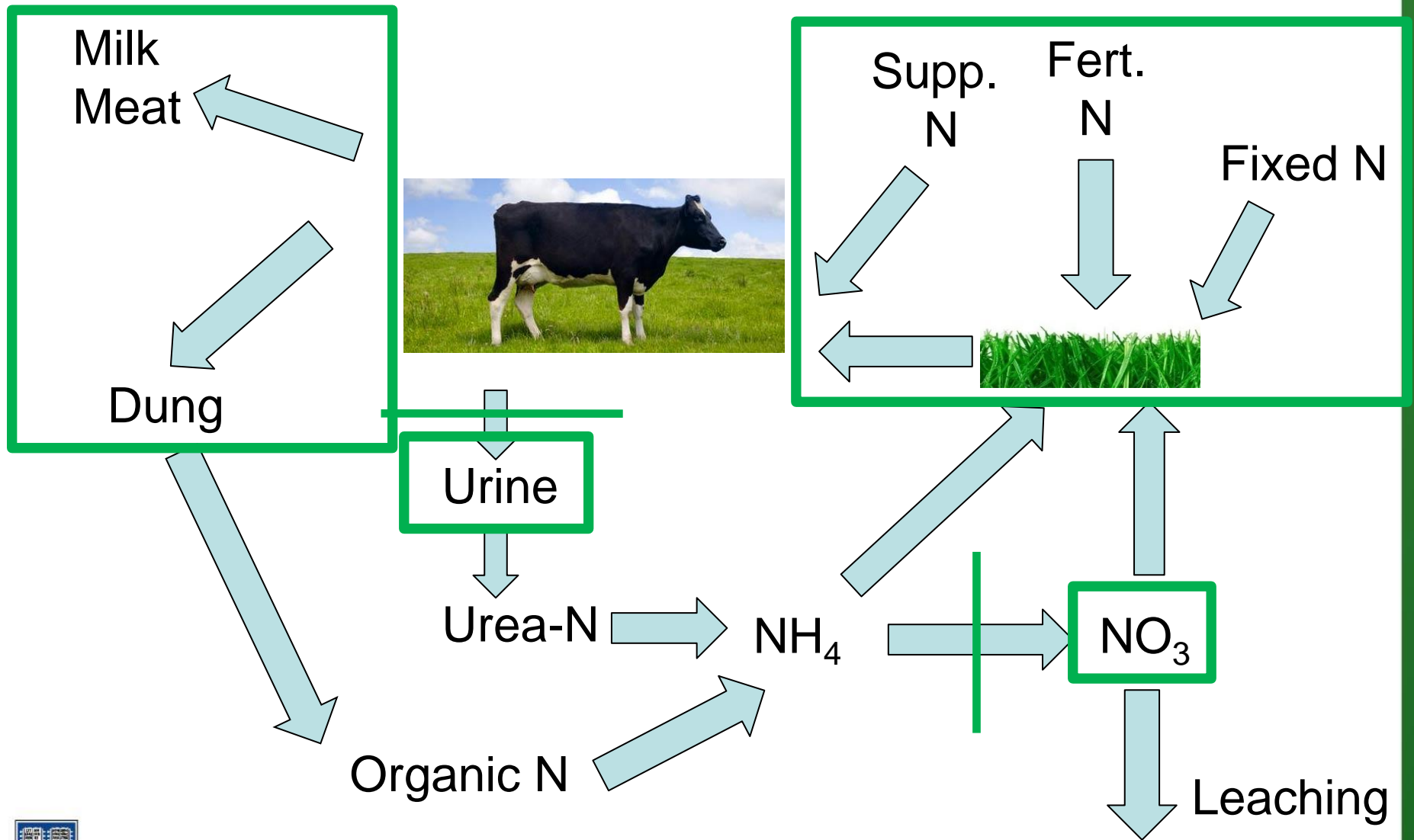


Changes on NZ dairy farms

	1990/91 to 2010/11
Herds	-20%
Area	+60%
Cows	+89%
Average herd size	+134%
Milk production (kg/cow)	+31%
Milk production (kg/ha)	+50%
Milk production (total)	+248%
Stocking rate (cows/ha)	+15%

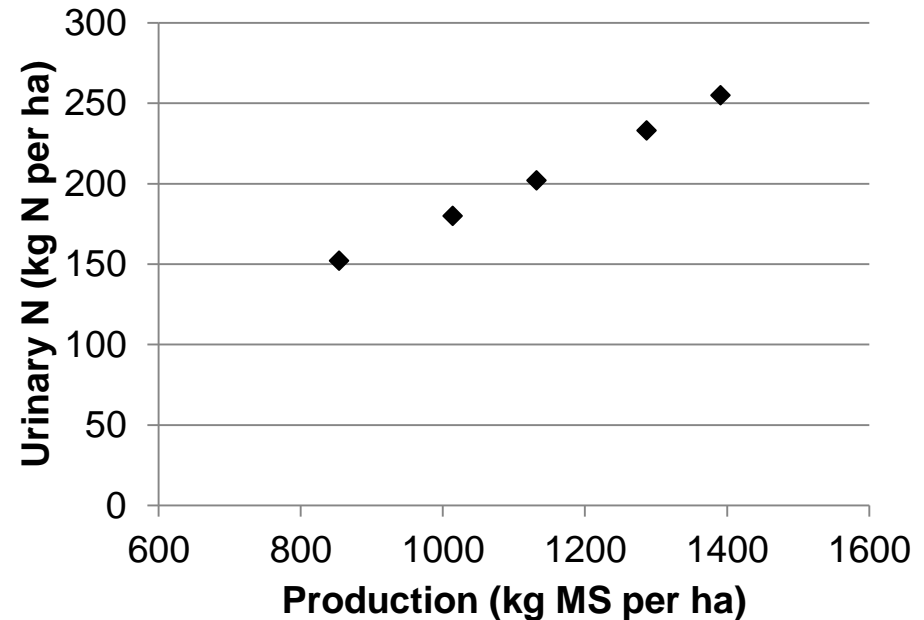


Dynamics of nitrate leaching



The problem is not bull crap...

- 60-90% of N excreted
- 70% of N as urinary N
- Around 25% of paddock covered each year
- N loading rate under patch is 1 t N ha⁻¹



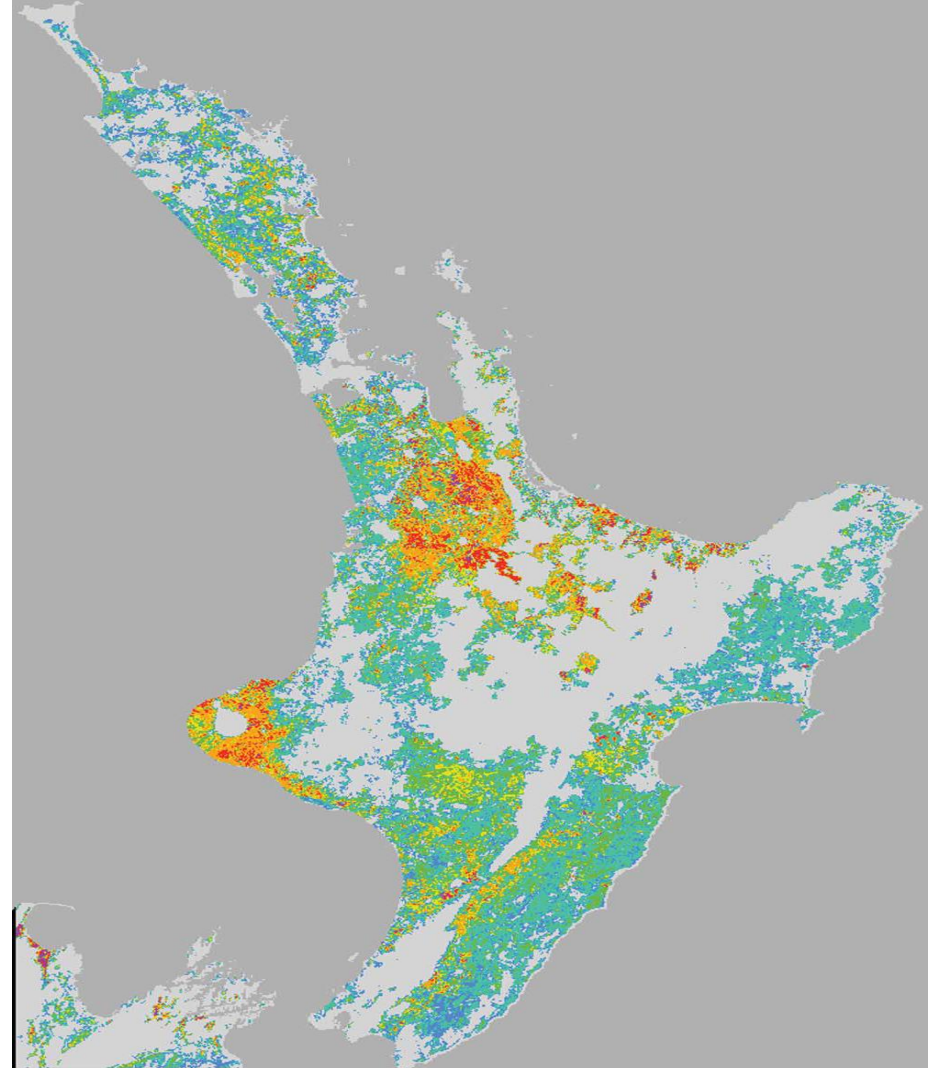
Source: Romera and Doole (2013)



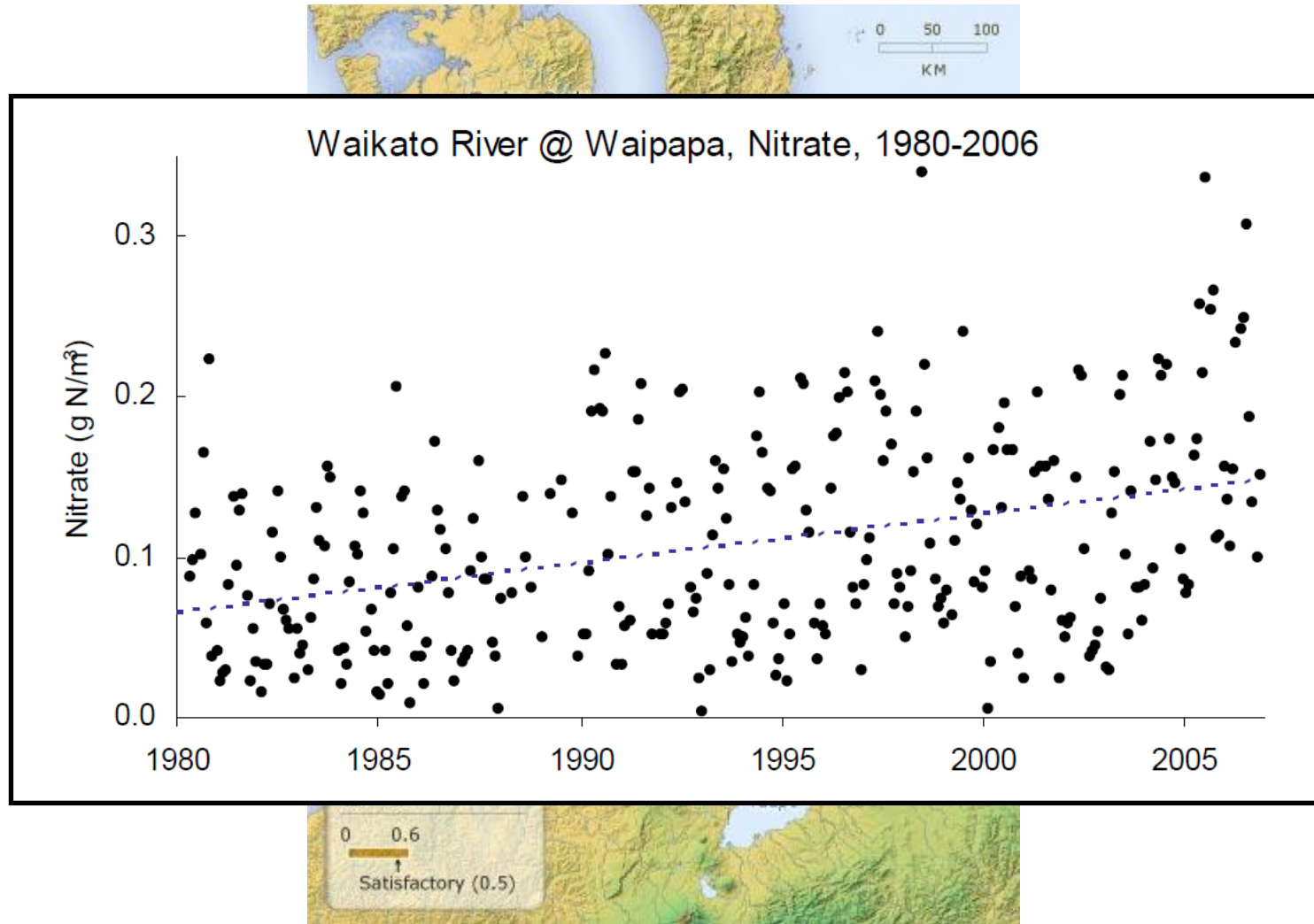
Nitrate leaching (kg N/ha/yr)

KEY:

- Grey (0–2 kg N)
- Blue (2–5 kg N)
- Turquoise (5–10 kg N)
- Green (10–15 kg N)
- Yellow (15–20 kg N)
- Orange (20–30 kg N)
- Red (30–40 kg N)
- Purple (>40 kg N)



Water quality decline is evident



Policy focus on water quality

- Manawatu: regulate leaching in OnePlan
- Taupo: policy for protection of Lake Taupo
- Canterbury: water quality and quantity limit setting process being undertaken
- Very political issue
- Extensive legal action



Do we need policy for water
quality improvement?



Adoption of mitigation practices

- Current systems are not compatible
- Moral suasion
- What is a win-win strategy?
- Can we rely on diffusion?
- Adoption theory: Pannell et al. (2006)



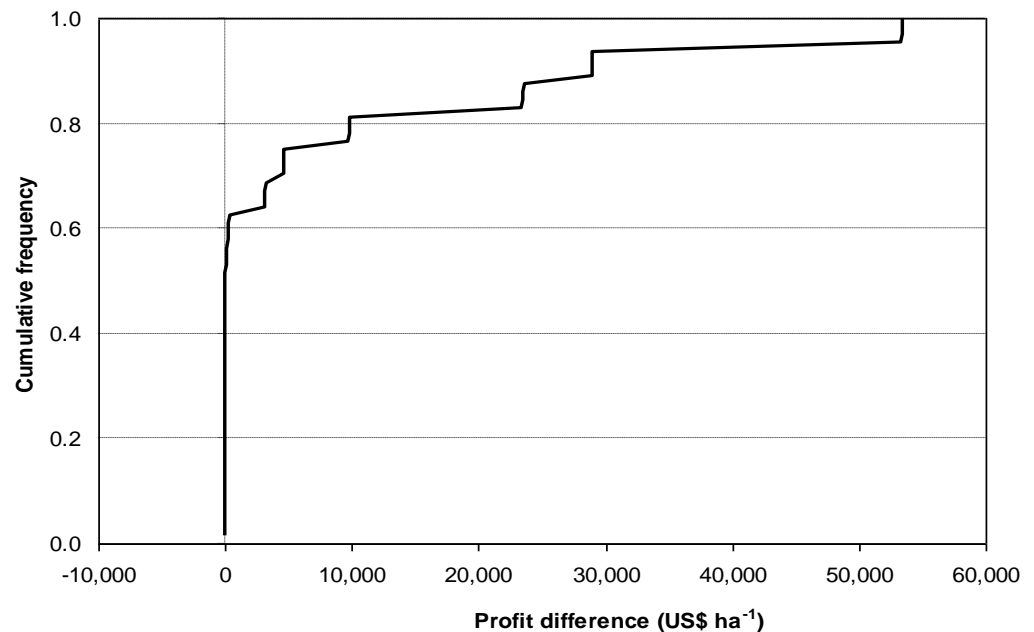
Relative advantage of an adoptable practice

- Economic benefits
 - ❖ Profitability
 - ❖ Riskiness
 - ❖ Compatibility
 - ❖ Complexity
 - ❖ Observability
 - ❖ Triallability
- Research in Aus. and NZ
- Value of farm modelling



Relative advantage of herbicides

- Herbicides vs hand weeding in Philippines
- Economic benefits
 - ❖ Profitability ✓
 - ❖ Riskiness ✗
 - ❖ Compatibility ✓
 - ❖ Complexity ✓
 - ❖ Observability ✓
 - ❖ Triallability ✓

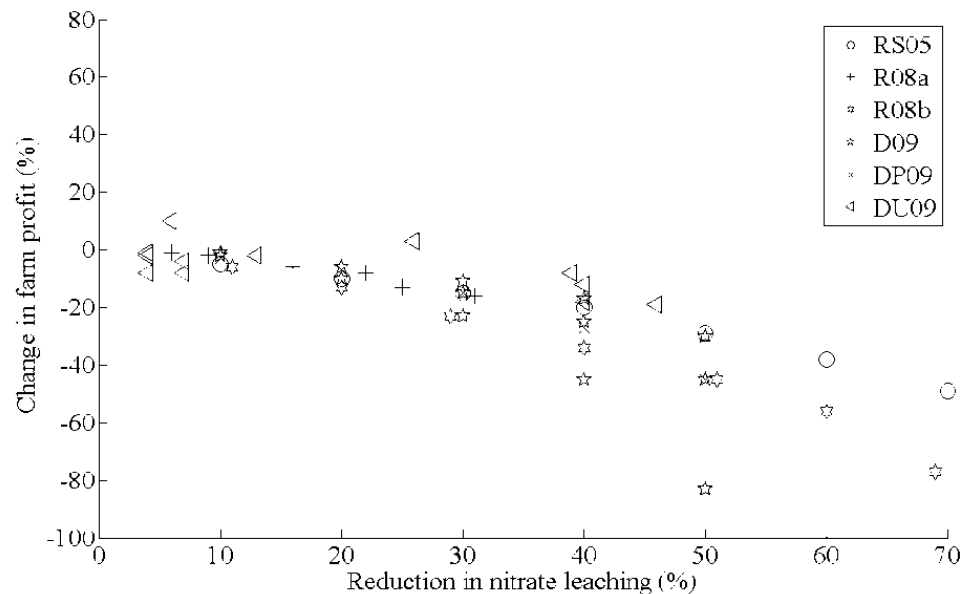


Source: Beltran et al. (2012)



General lack of profitable mitigations

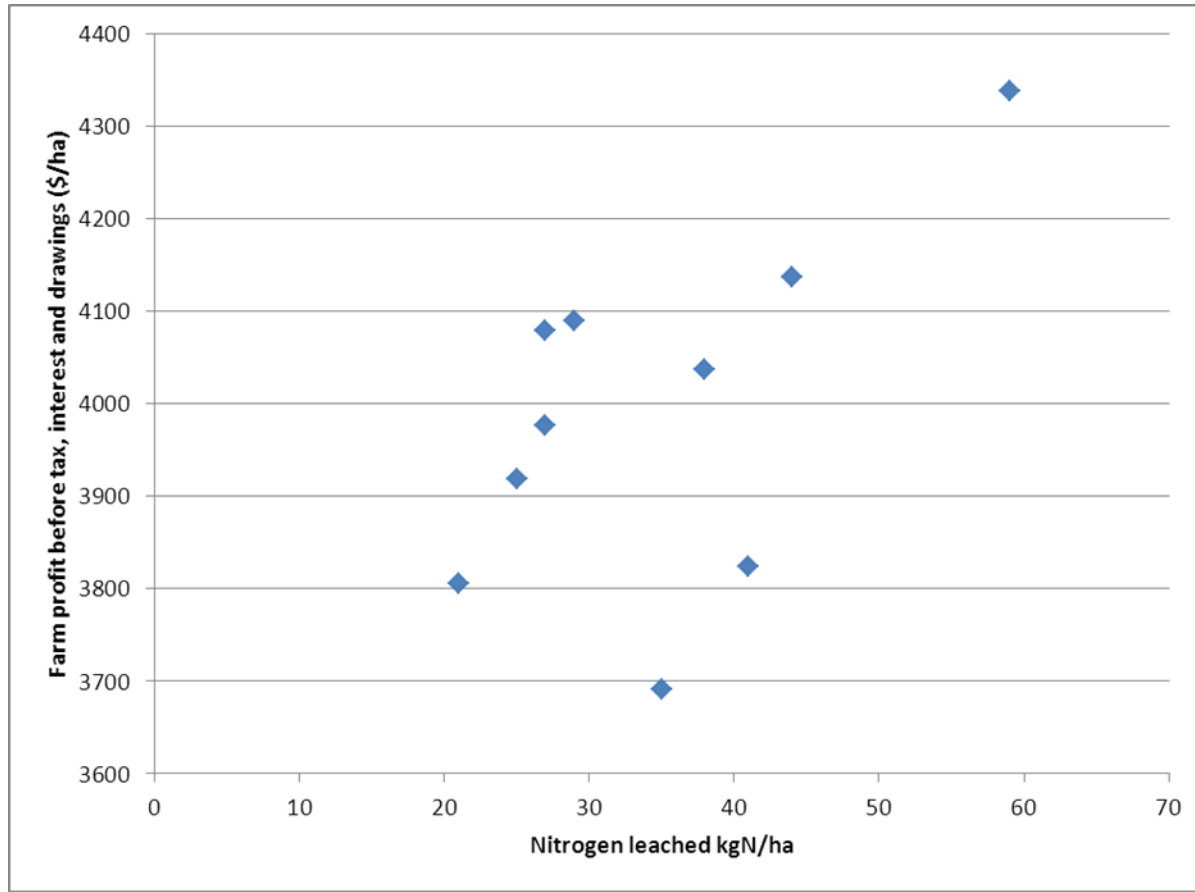
- Profitability is a key driver for adoption
- What incentive exists when a practice is unprofitable?
- General lack of win-win strategies



Source: Doole (2010)



Sam Howard: case study farm



Evaluation toolbox results

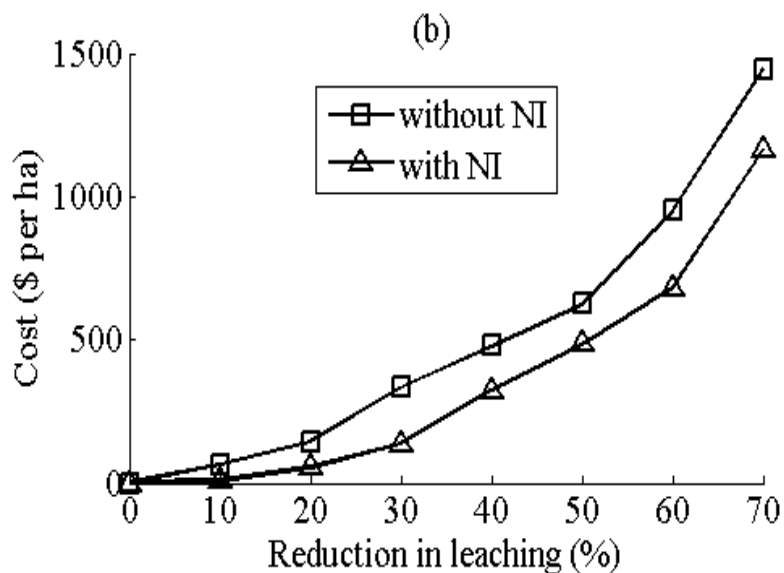
Cost-effectiveness of mitigations on a Waikato dairy farm.

Mitigation	Change in annual profit (%)	Reduction in N leaching (kg N)
Nitrification inhibitors	-14	6–18
Low rate effluent application	-3	0–1
No nitrogen fertiliser	-49	25–35
Low N feed	-15	20–30
Restricted autumn-winter grazing	-9	20–35
Low-cost winter pad	-44	15–30
Herd shelter	-79	15–30
Construct wetland	-24	10–40



Is DCD the bronze bullet?

- DCD slows enzymes
 - ❖ ↑ pasture production (?)
 - ❖ ↓ environmental impact
- High cost of DCD
 - ❖ Profit ↑ by 2%
 - ❖ N leaching ↓ by 9%
- Negative feedback
 - ❖ SR ↑ by 5%
 - ❖ MP ↑ by 5%
- Residue problem!



Source: Doole and Parangahawewa (2011)



Lack of win-win solutions
necessitates policy intervention.

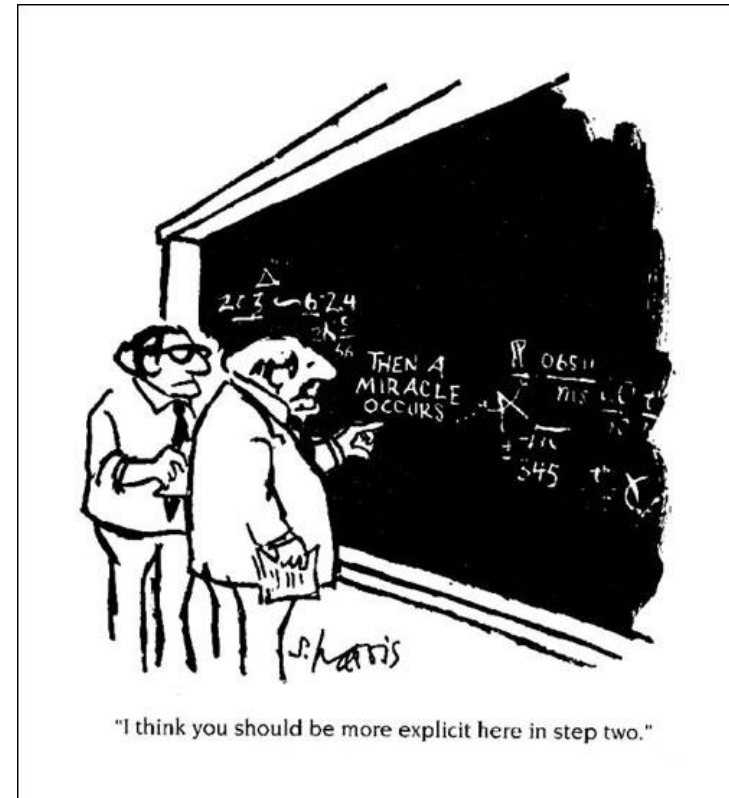


Are there any policy challenges?



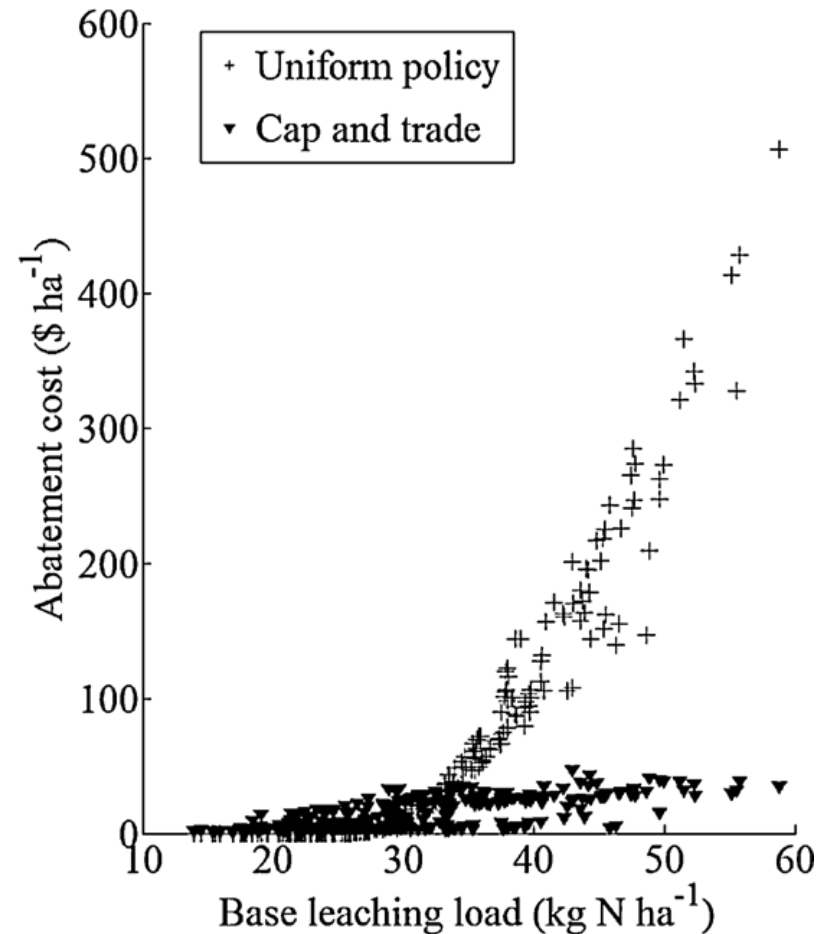
Finding policy solutions is hard

- Complex problem
- No clear policy solutions
- Difficulties:
 - ❖ Multiple farmers
 - ❖ Hidden actions
 - ❖ Unclear benefits
 - ❖ Stochastic impacts
 - ❖ Catchment modelling



Multiple farmers across space

- Predict actions of multiple farmers
 - ❖ Farms vary
 - ❖ Farmers vary
- Exacerbates uncertainty
- Model individual farms and farmers
- Match data availability

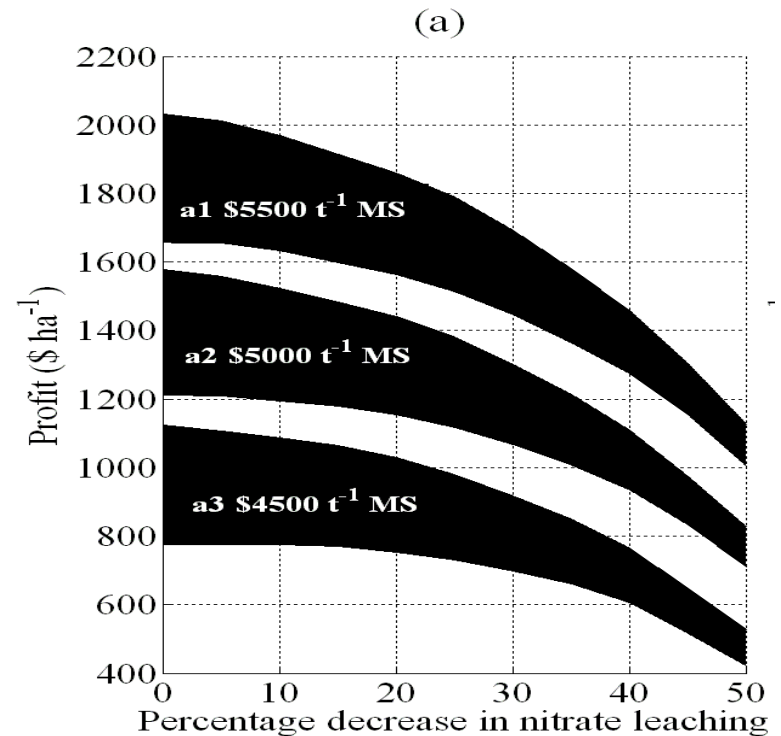


Source: Doole et al. (2013)



Predicting farmer behaviour?

- Do not know behaviour of farmers
- Monitoring is difficult and costly
 - ❖ When is stand-off used?
- OVERSEER is required
 - ❖ Cost
 - ❖ Quality

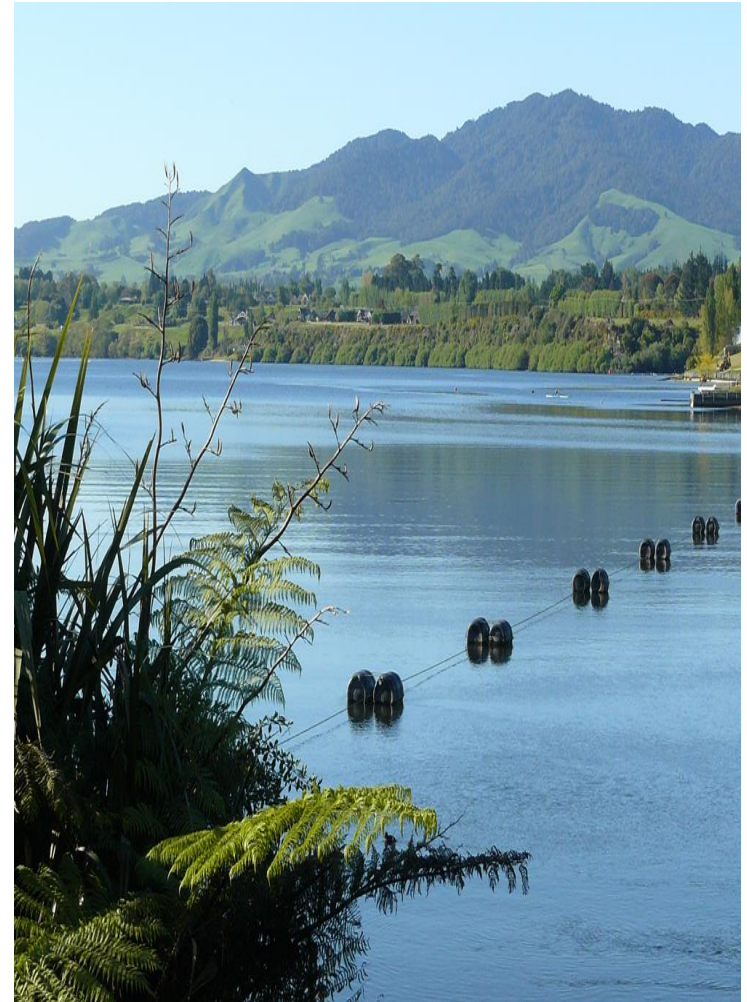


Source: Doole and Pannell (2011)

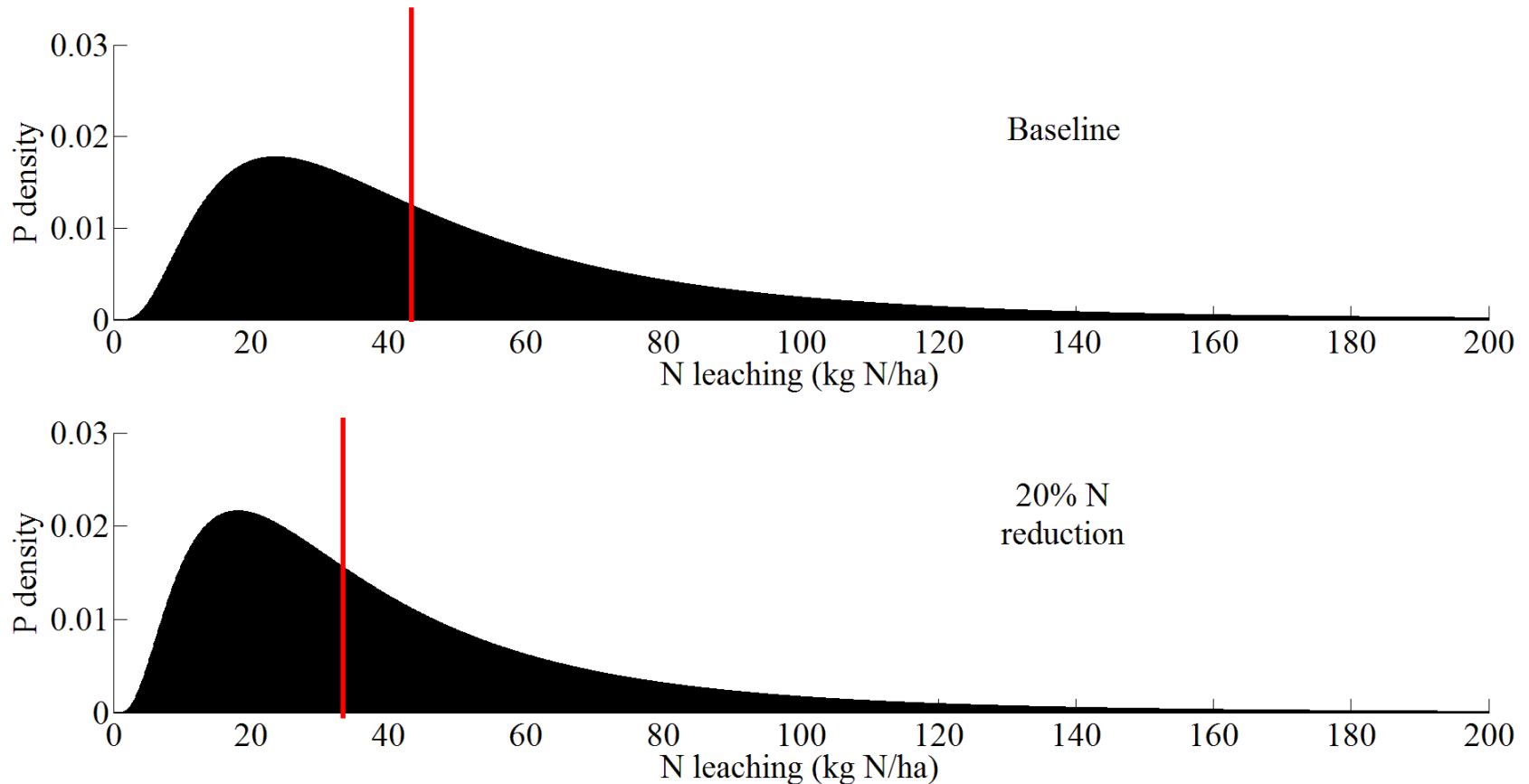


Unclear benefits

- Env. decisions need good data on values
- NPS for Freshwater Management 2011
- Set standards → evaluate cost
- Easier than linking to non-market values?



Annual variation of farm N leaching

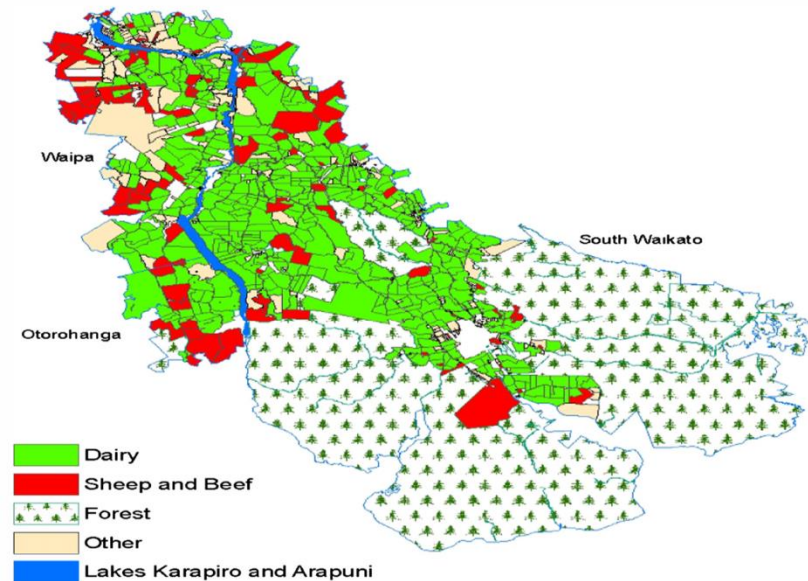


Source: Doole and Romera (2013)



Catchment modelling is difficult

- Predict how mitigation use and land use change with policies
- Difficult to do well:
 - ❖ Quality of input data
 - ❖ Calibration
 - ❖ Time
 - ❖ Dynamics of land-use change
- Best we have?



Source: Doole et al. (2011)



Designing appropriate policy interventions is difficult.

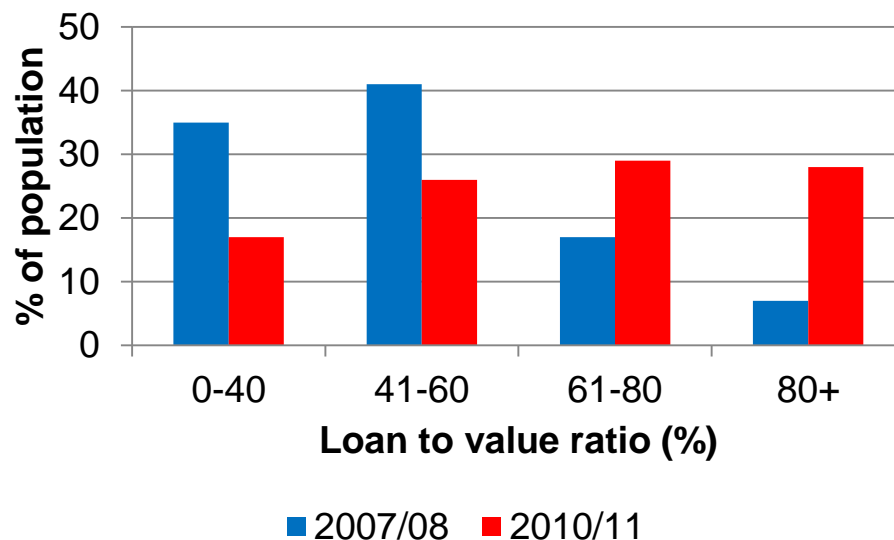
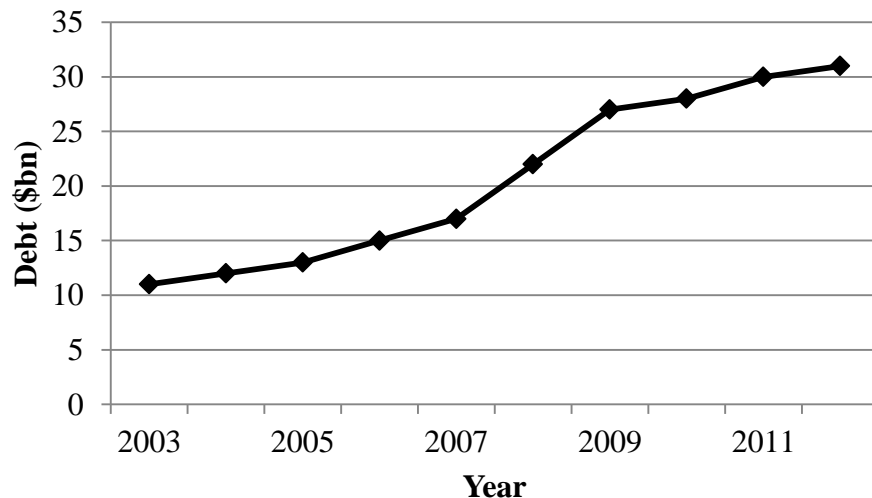


Are there other on-farm issues
we need to consider?



Debt pressures

- Dairy expansion has fuelled debt
- Interest of \$1.5 kg MS, expenses of \$5 kg MS
- High LVR
- 10-20% of farmers hold half of the debt
- Capacity to cope with abatement cost?



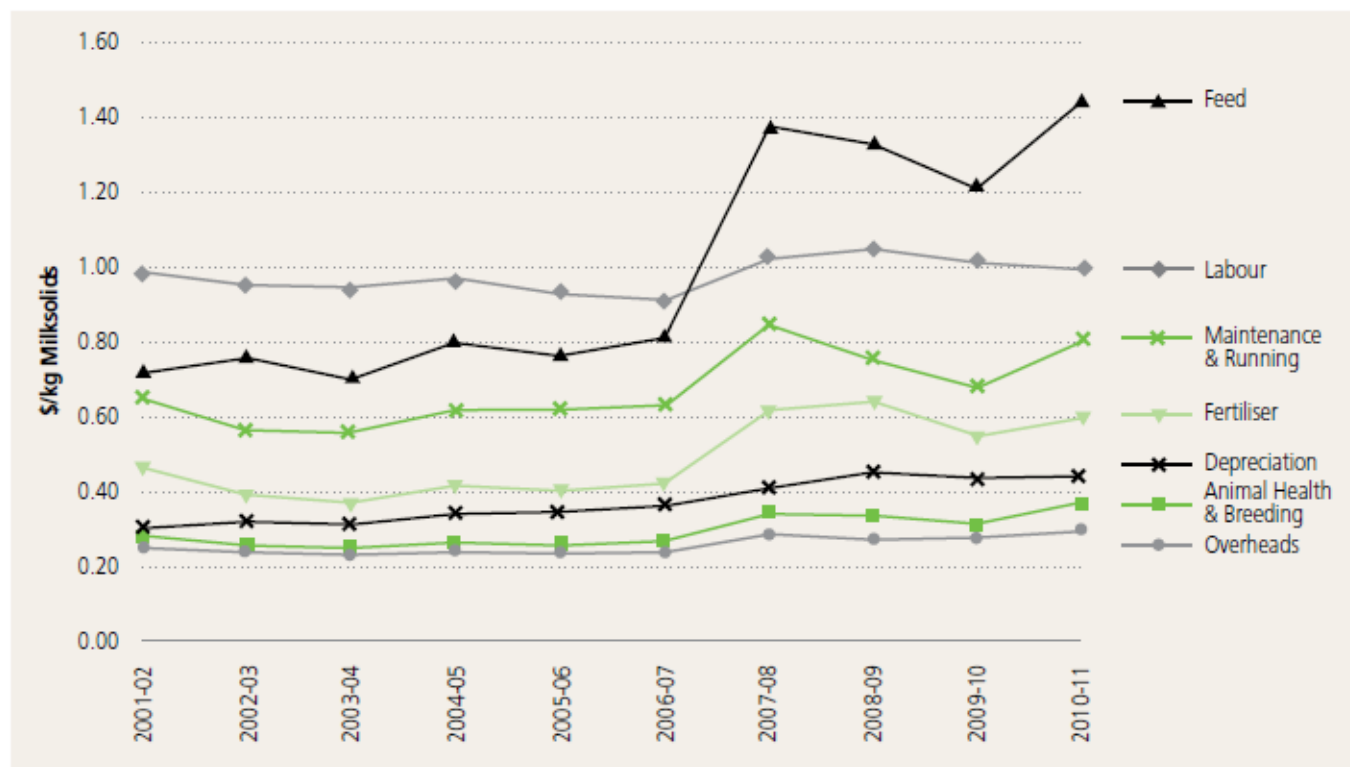
Pressure to increase production

- Milk prod. expected to grow by 15% to 2020
- Government investment in irrigation (420k ha)
- Key competition:
 - ❖ South America (low cost, large capacity)
 - ❖ India/China (↑35% by 2018)
- Product safety



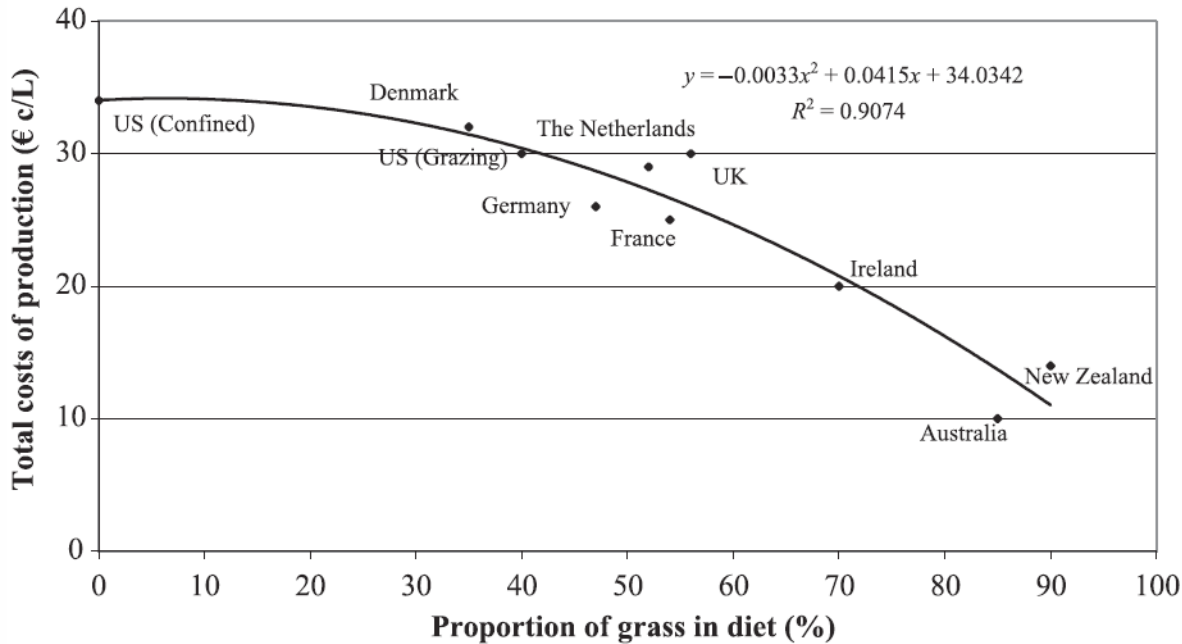
Pressure on input costs

- Steady increase in input costs over last decade
- Fertiliser and feed costs are growing



Pressure on system

- Increasing supplement use
- Farms using >10% supp. ↑ 30% over last decade
- Cost ↑ with supplement use



New Zealand dairy farmers are under significant pressure.



Summary



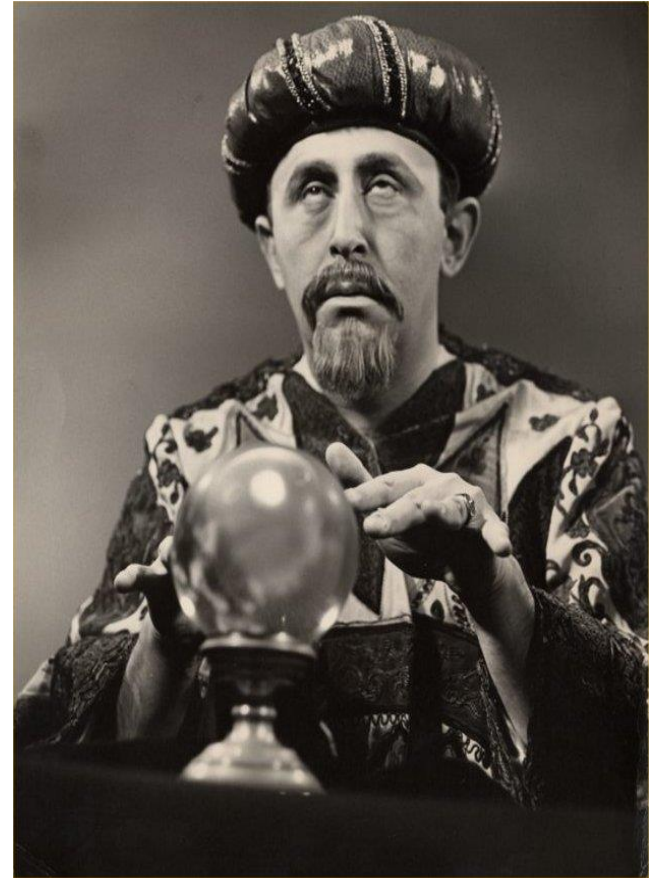
Prognosis: Unhappy marriage

- Broad uptake could dispel problem
- Tension between economics and env.
- Motivates need for R&D
- Motivates need for policy
- Working together during policy setting



The future...

- There are no easy answers
- Readjustment of industry?
- Loss of competitiveness?
- Develop or find profitable mitigations?
- Can we design/adopt new systems?





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Thank you to D. Adamson, J. Quiggin, D. Pannell, A. Roberts, K. Stott, S. Howard, M. Newman, and A. Romera for providing comments on earlier drafts.

