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An ode to output-based regulation

Mark Neal

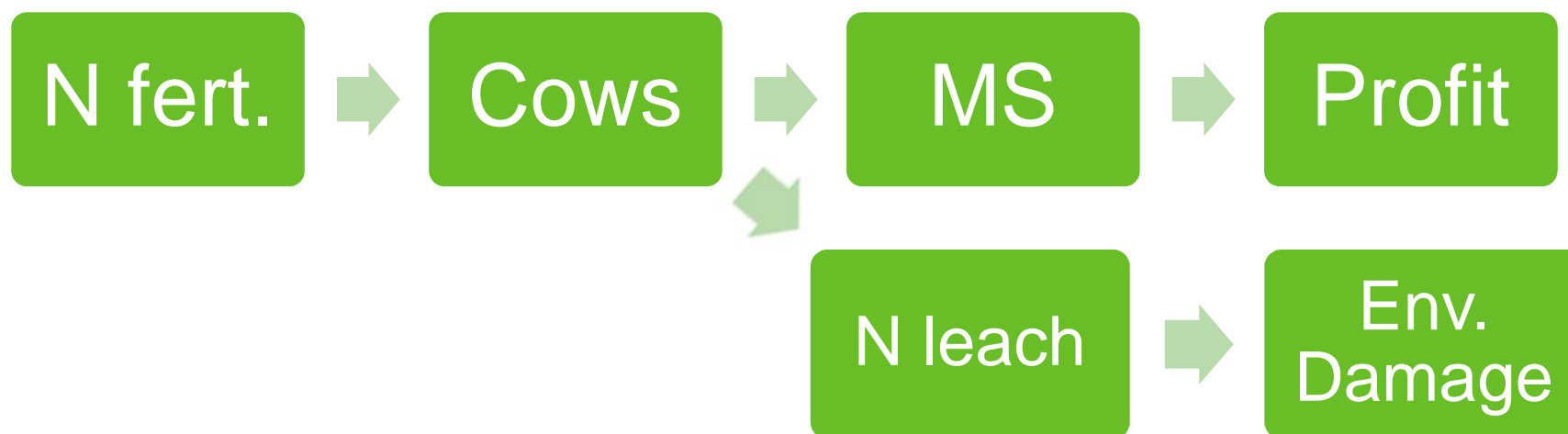
DairyNZ 

Let's fix the problem!

- The Government needs to set "appropriate limits on fertiliser application and stock levels"
 - Labour Party water and environment spokesman David Parker

June 28, 2016. Stuff.co.nz

Simple Production function



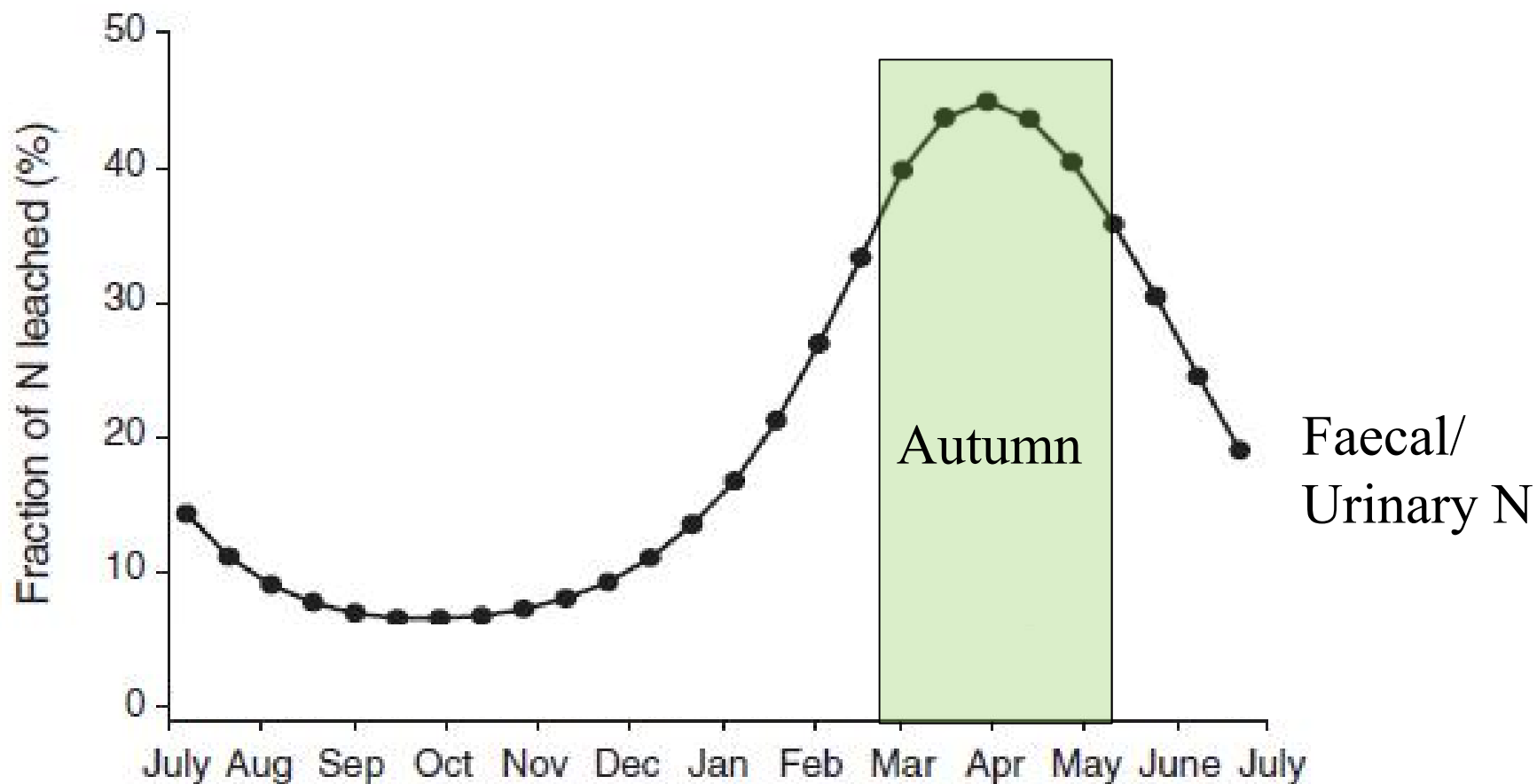
Stocking rate farmlet trial

	<u>A</u>		<u>E</u>
Stocking rate, c/ha	2.2		4.3
N Fertiliser, kg N/ha		Equal	
Production, kg MS/ha	~900		~1140
Profit, \$/ha		~Equal	
N leaching, kg N/ha	50		?

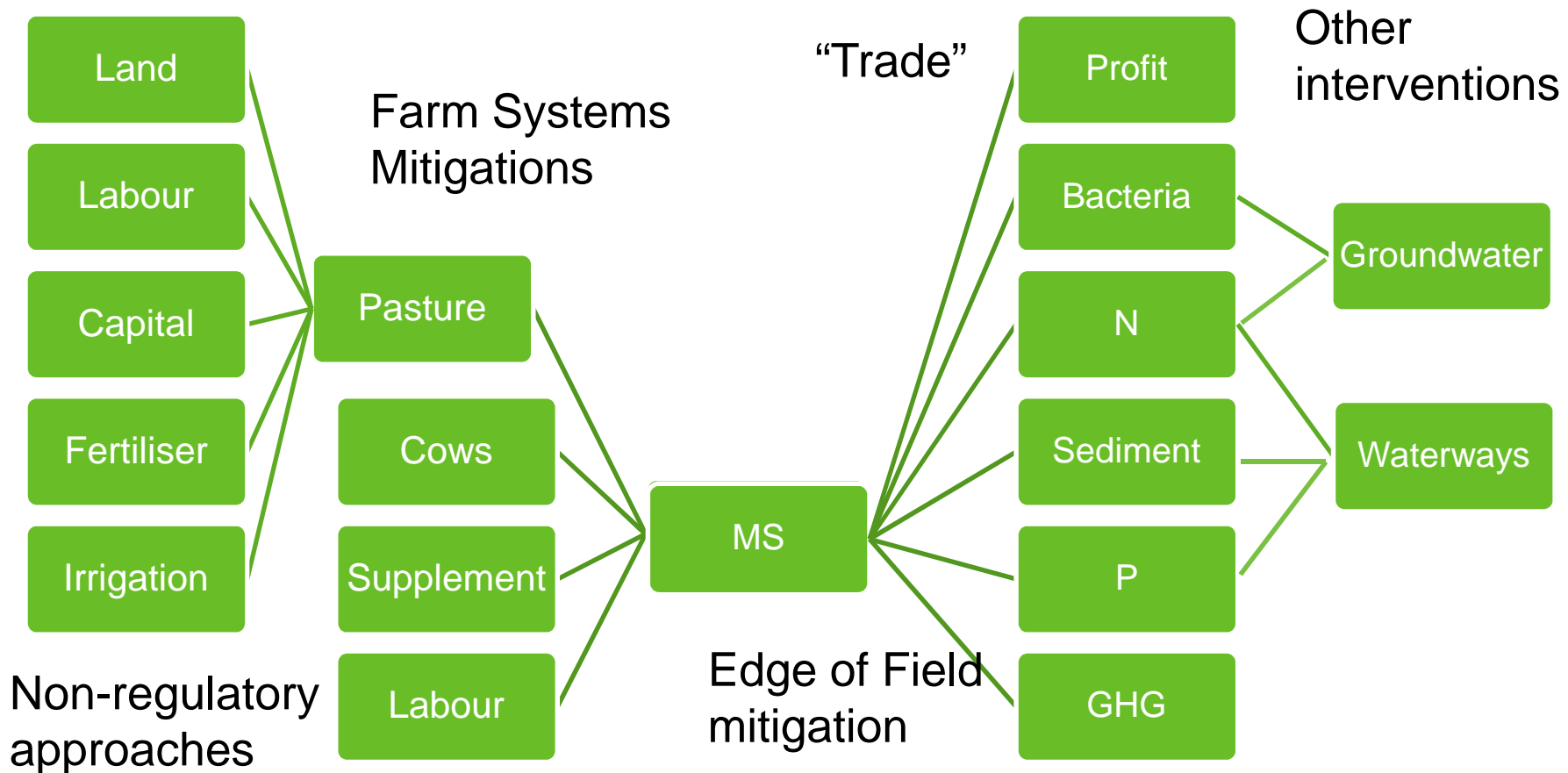
Stocking rate farmlet trial

	<u>A</u>		<u>E</u>
Stocking rate, c/ha	2.2		4.3
N Fertiliser, kg N/ha		Equal	
Production, kg MS/ha	~900		~1140
Profit, \$/ha		~Equal	
N leaching, kg N/ha	50		20

Likelihood of N loss



Actual Production function



Efficiency

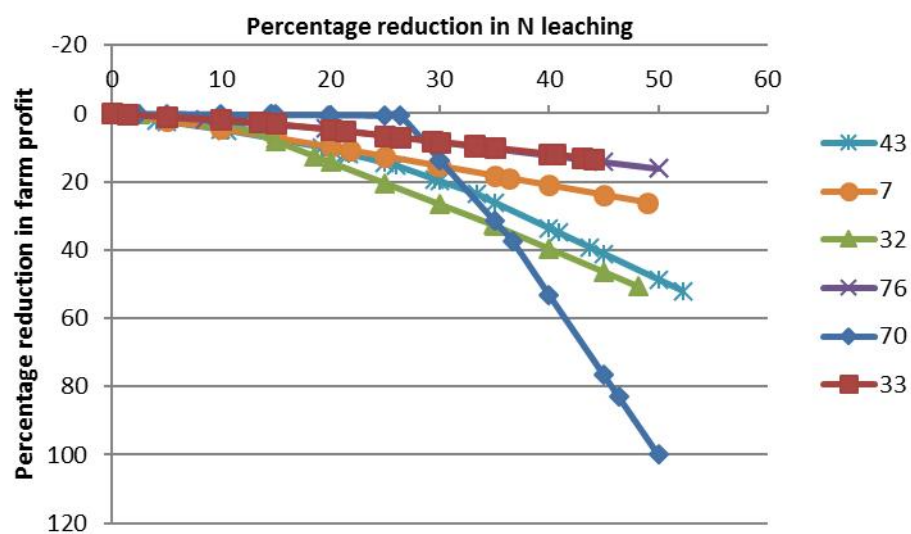
- Resource availability
- Managerial ability
 - Graze at 2 vs 3 leaf (Chapman et al.)
 - No feed wedge, fast rotation vs slow rotation (Bryant et al.)
- Future
 - New plant breeds

Standard mitigation approach

- System adjustment (not radical change)
- Apply GMP's (cheapest gains)
- Keeping the cows diet and MS/cow constant:
 - Reduce N fert
 - Reduces feed available (x%)
 - Reduce stocking rate pro rata (x%)
- Infrastructure comes next

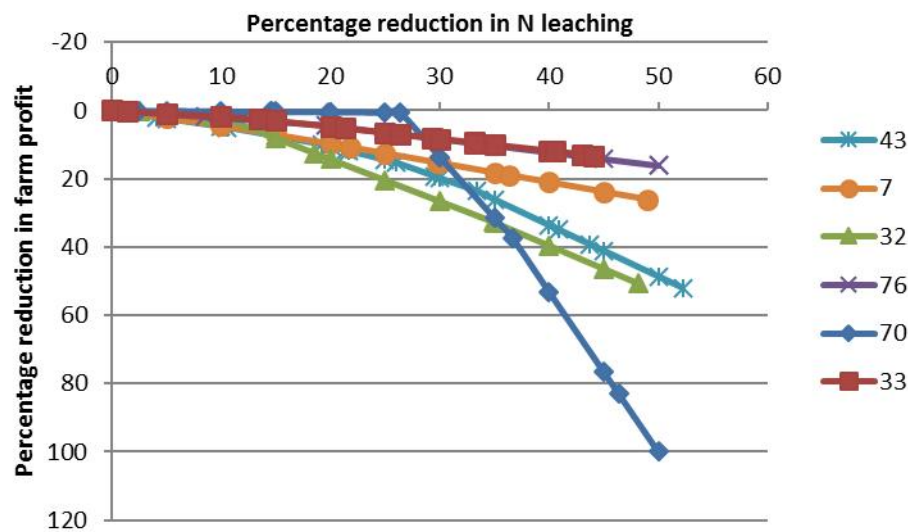
Abatement curves

Percentage

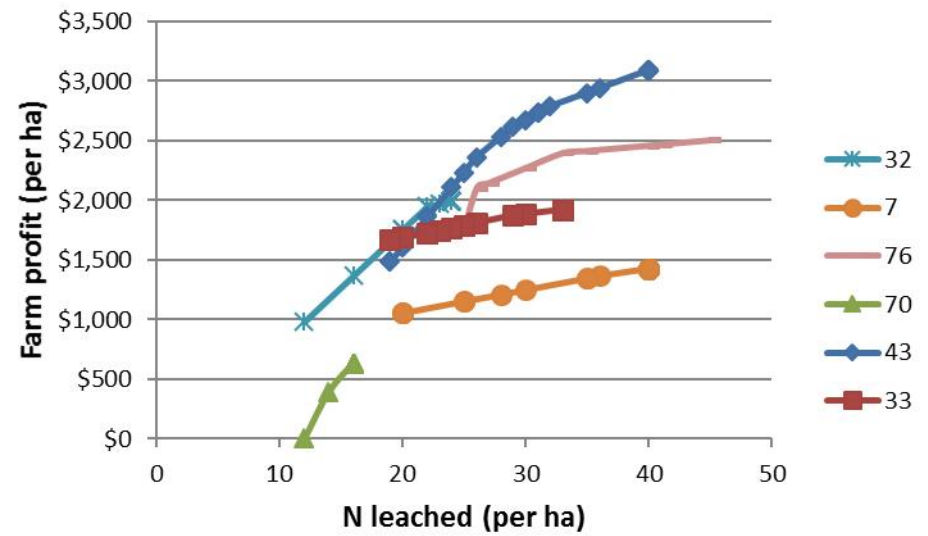


Abatement curves

Percentage

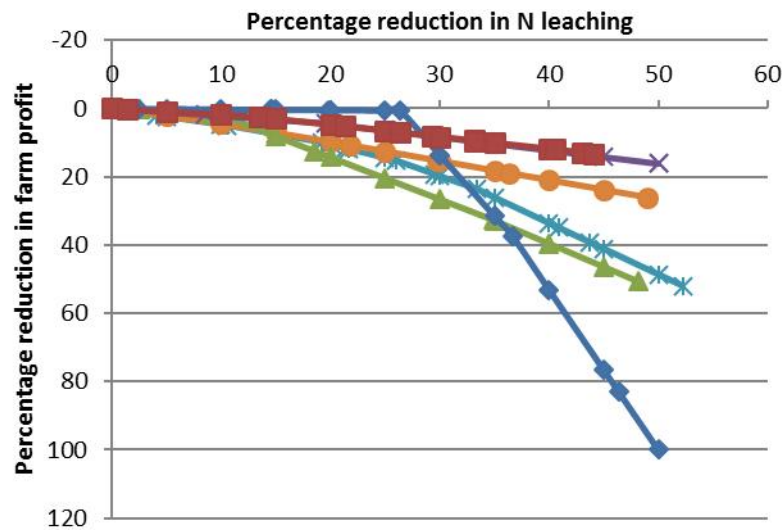


Absolute

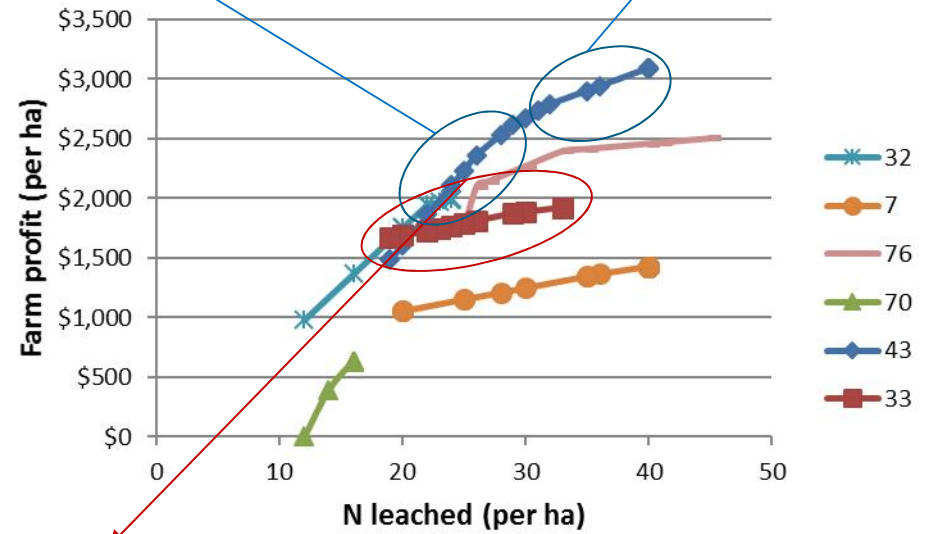


Abatement curves

Percentage



Absolute



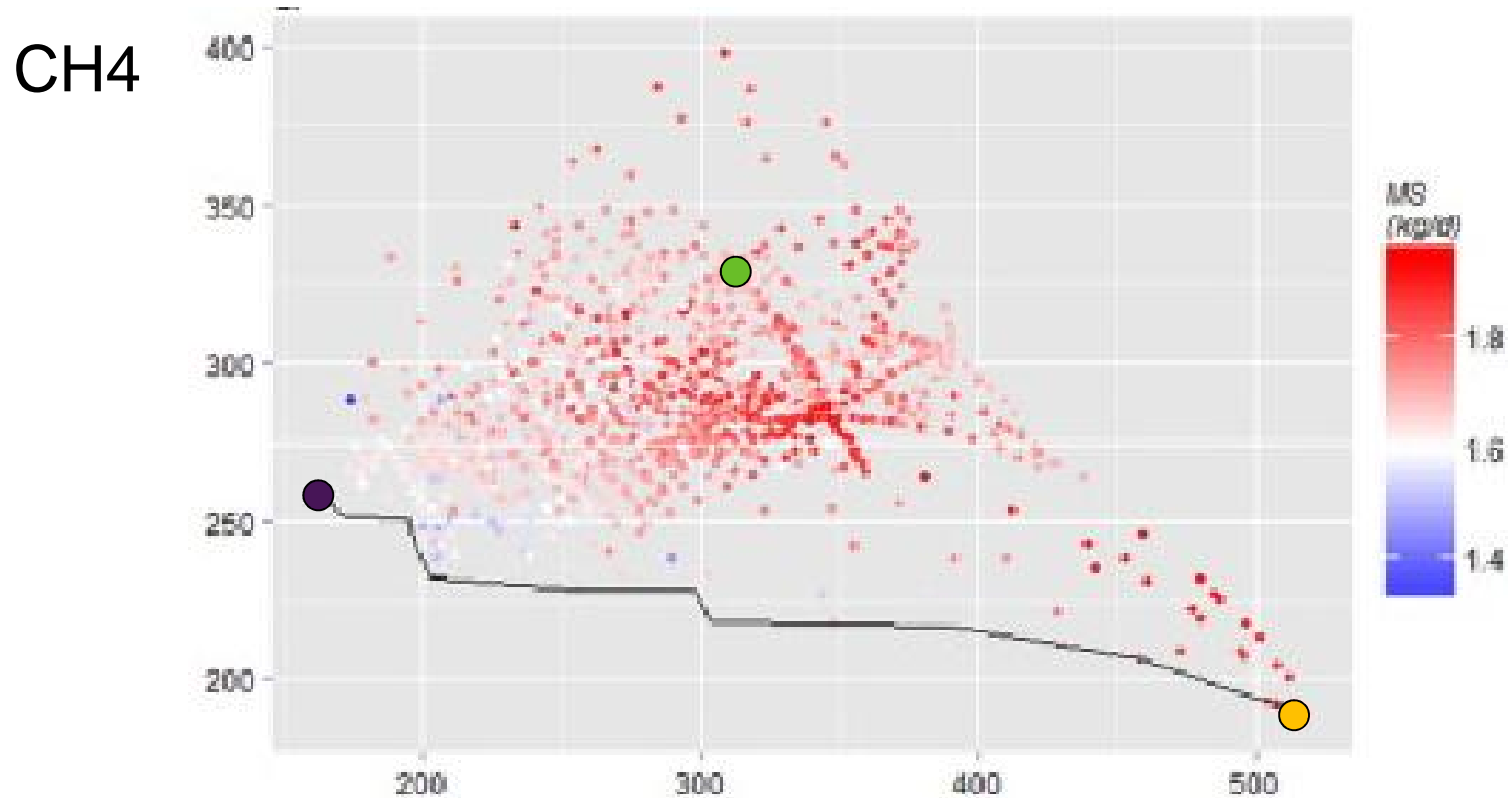
N mitigation vs P mitigation: FSM

Reduction
in P loss

Reduction
in N loss



N mitigation vs GHG mitigation: Diet



Gregorini et al. 2016

Urinary N

DairyNZ

Trade – an opportunity?

- Heterogeneity -> benefits from trade
 - Between farms of one class
 - Between classes of farms
- Doole (2012), 30% reduction N
 - Differentiated (Trade); Cheapest
 - Uniform %; Cost +40%
 - Reduce to threshold; Cost +300%

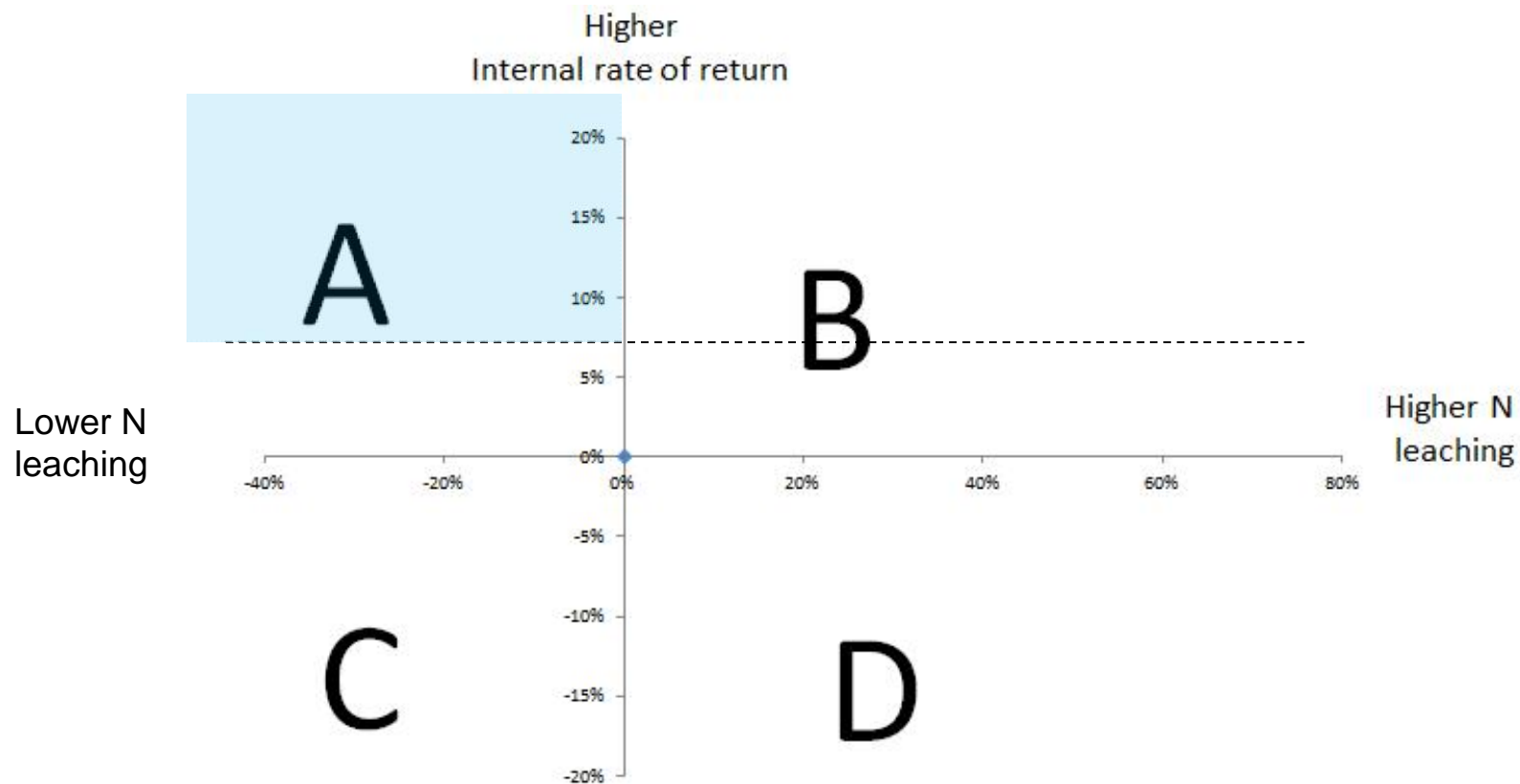
Coase and property rights

- As long as transactions costs are not excessive:
- Whether property rights are assigned to farmers or environment doesn't effect final abatement result.

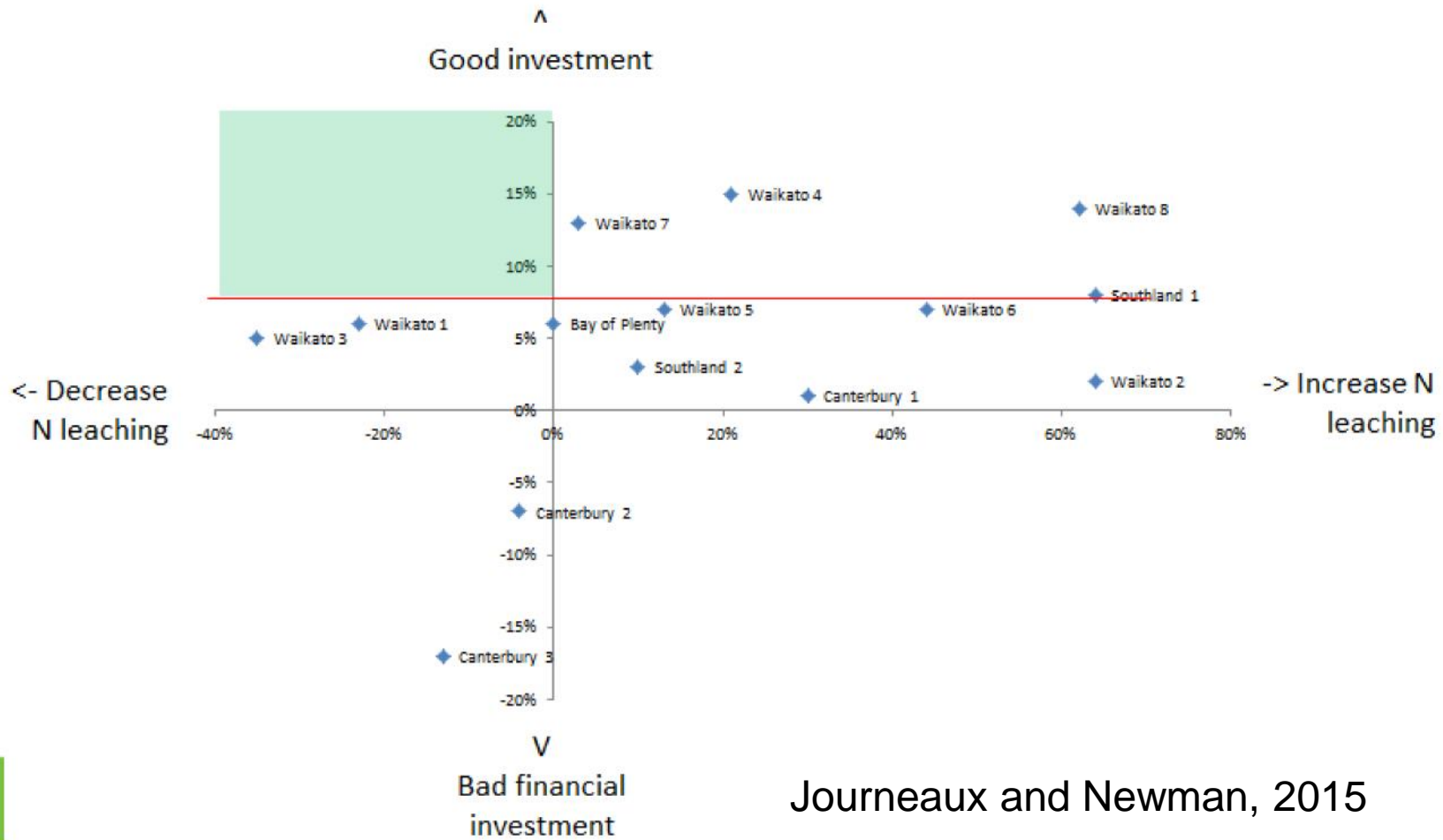
Tax or tradeable permits?

- If set at the appropriate levels:
- Can have exactly the same abatement result

Barns



Barns



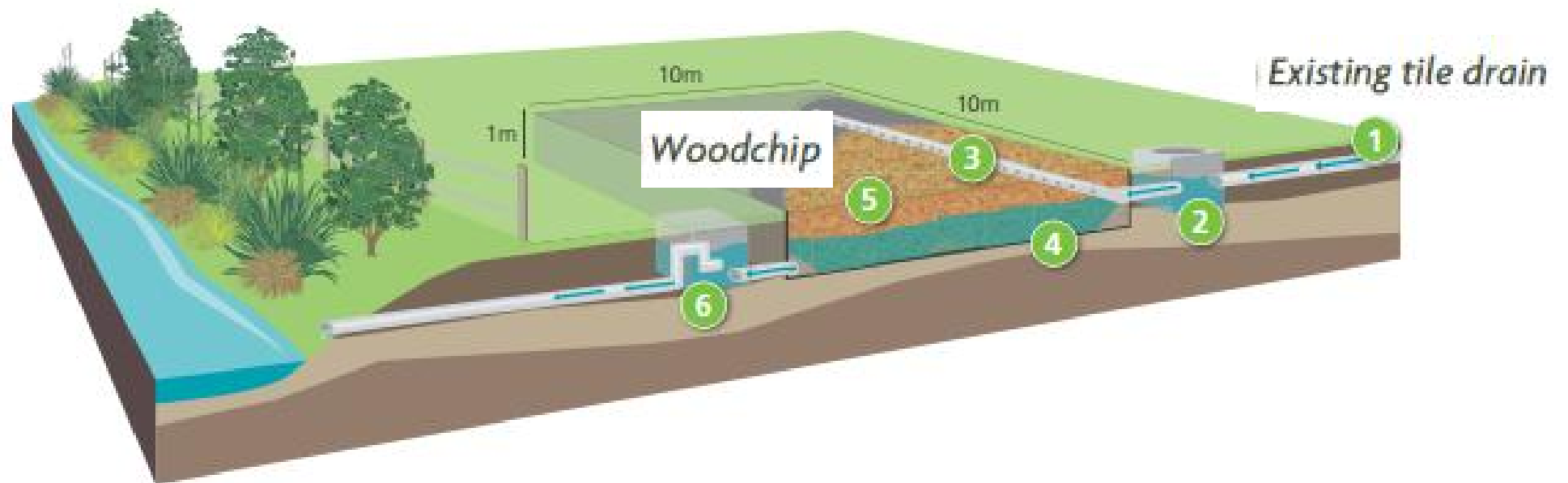
Journeaux and Newman, 2015



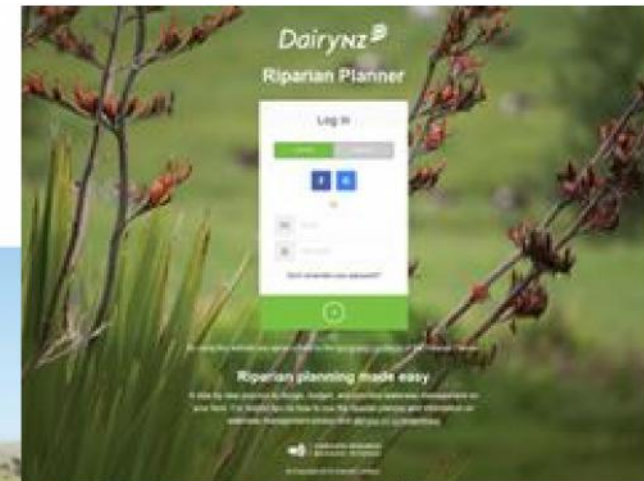
Artificial wetlands



Nitrate Catcher



Riparian planting



Aquifer recharge

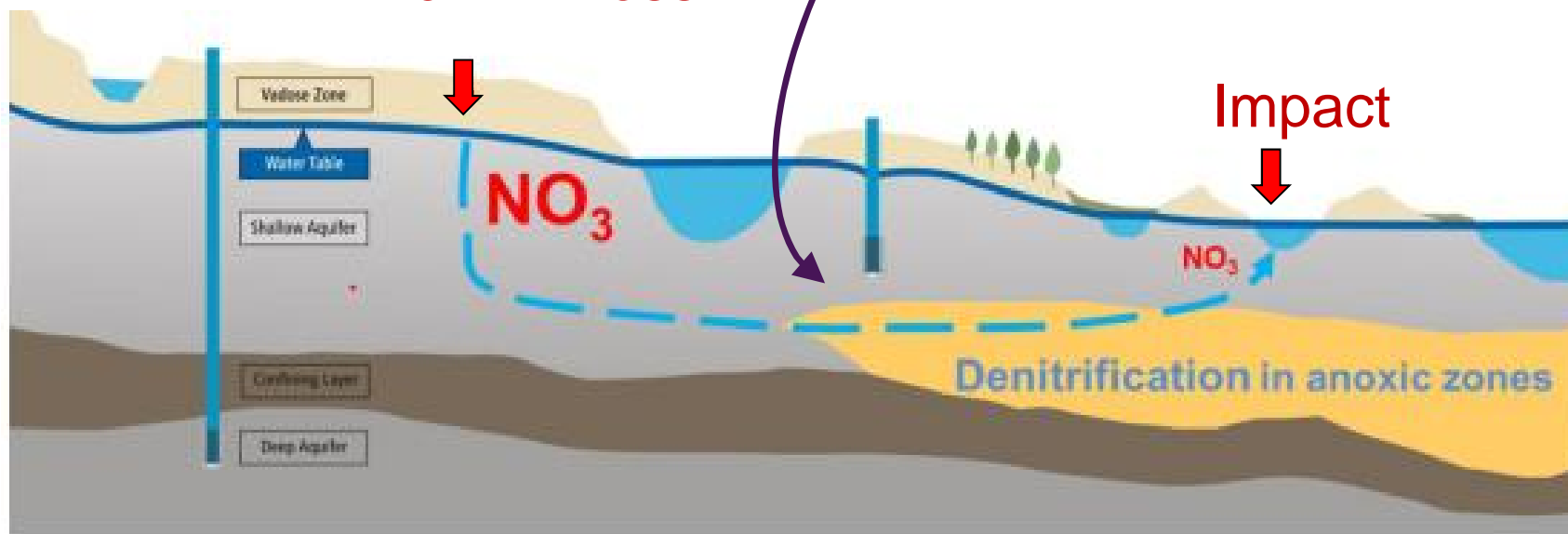


Attenuation

Distance,
Time lag,
Denitrification potential

Farm N loss

Impact



Sustainable milk plans

- Upper Waikato; 700 farms
- Current
 - 5% for N, 12% for P
- Expected
 - 8% for N, 21% for P

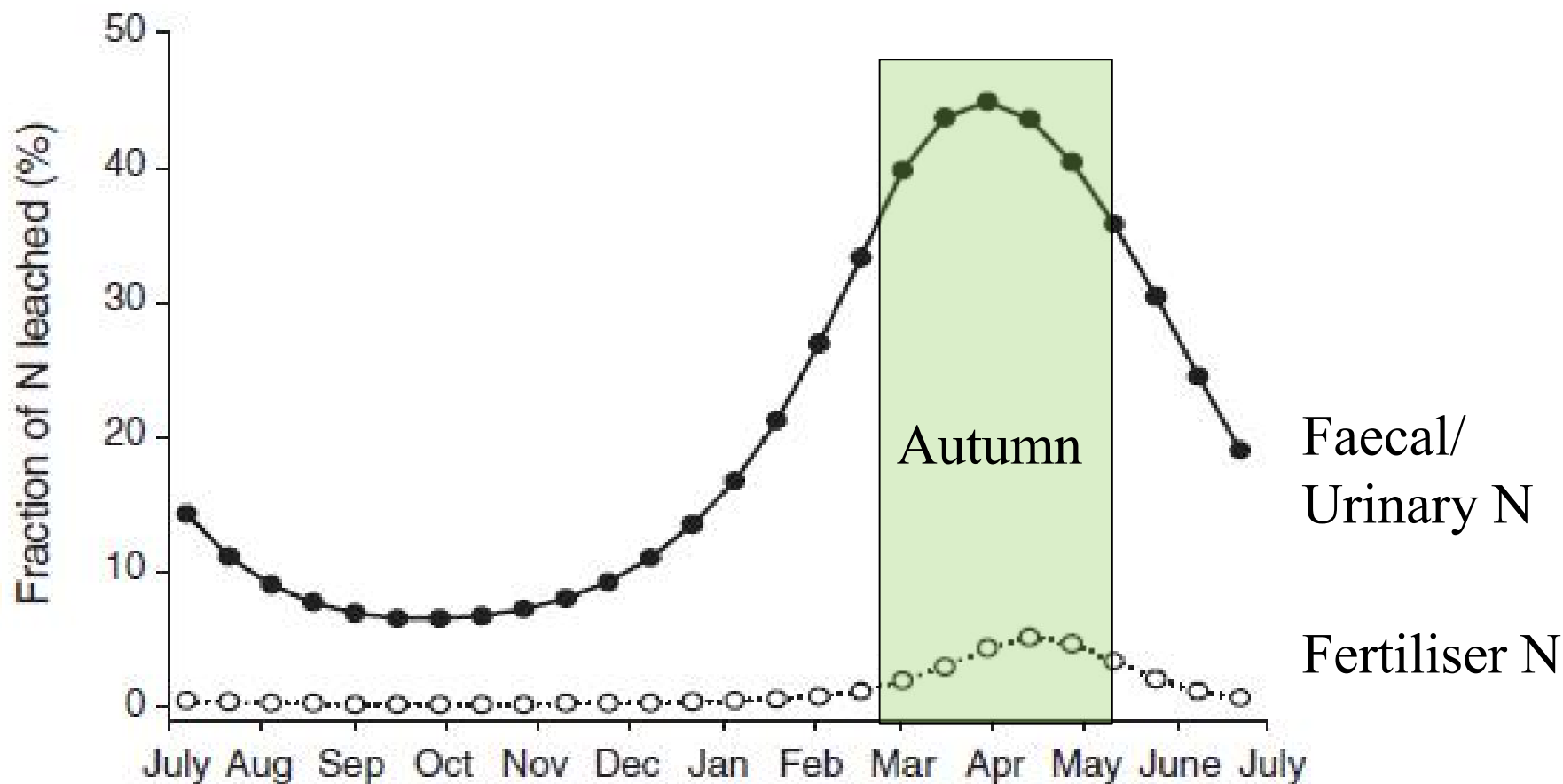
Good Management Practice

- Industry agreed (in principle)
- How is it quantified and modelled?
- MGM: Don't have to do GMP
 - Just meet the number
 - *“... the GMP Loss Rate number is inseparable from the GMPs ...is only able to be achieved ...”*

N restrictions

- N in winter: Eliminate
 - Low response (but high value)
 - High loss rate?

Likelihood of N loss



N restrictions

- N in winter: Eliminate
 - Low response (but high value)
 - High loss rate?
- N amounts overall: Cap monthly
 - Diminishing returns?
 - Substitute for supplement?

Irrigation efficiency as mitigation



Conclusions

- Policy aim
 - Meeting catchment objectives at least cost
- Input restrictions don't do this!
- Tradable permits are possible, but:
 - Initial allocation?
 - Who bears uncertainty?
- Output-based regulation, with some flexibility
 - An acceptable middle ground?