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An ode to output-based regulation

Mark Neal

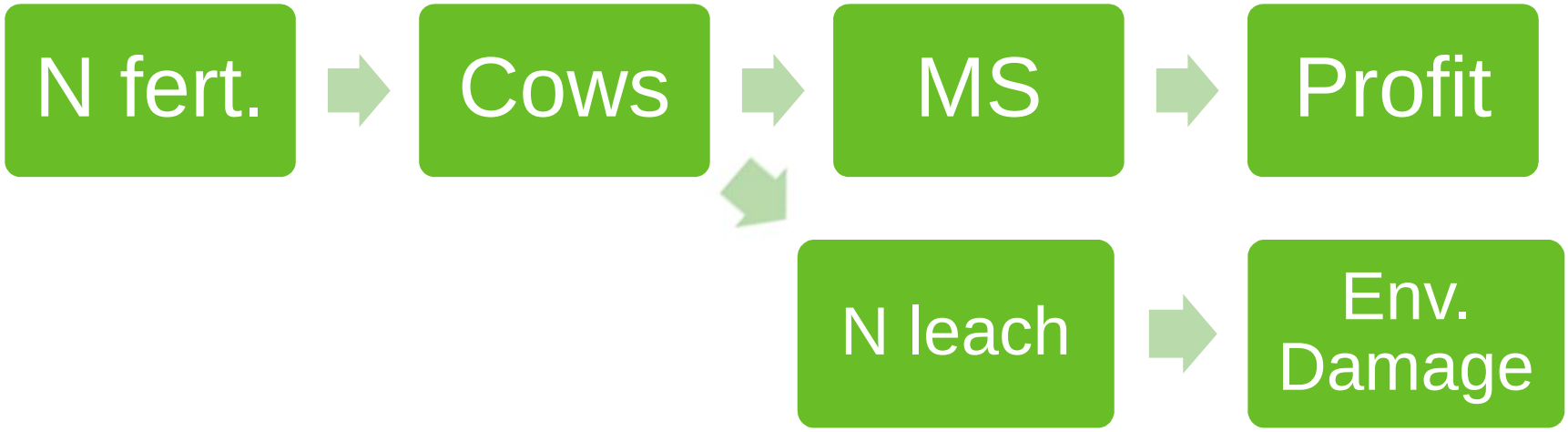
DairyNZ

Let’s fix the problem!

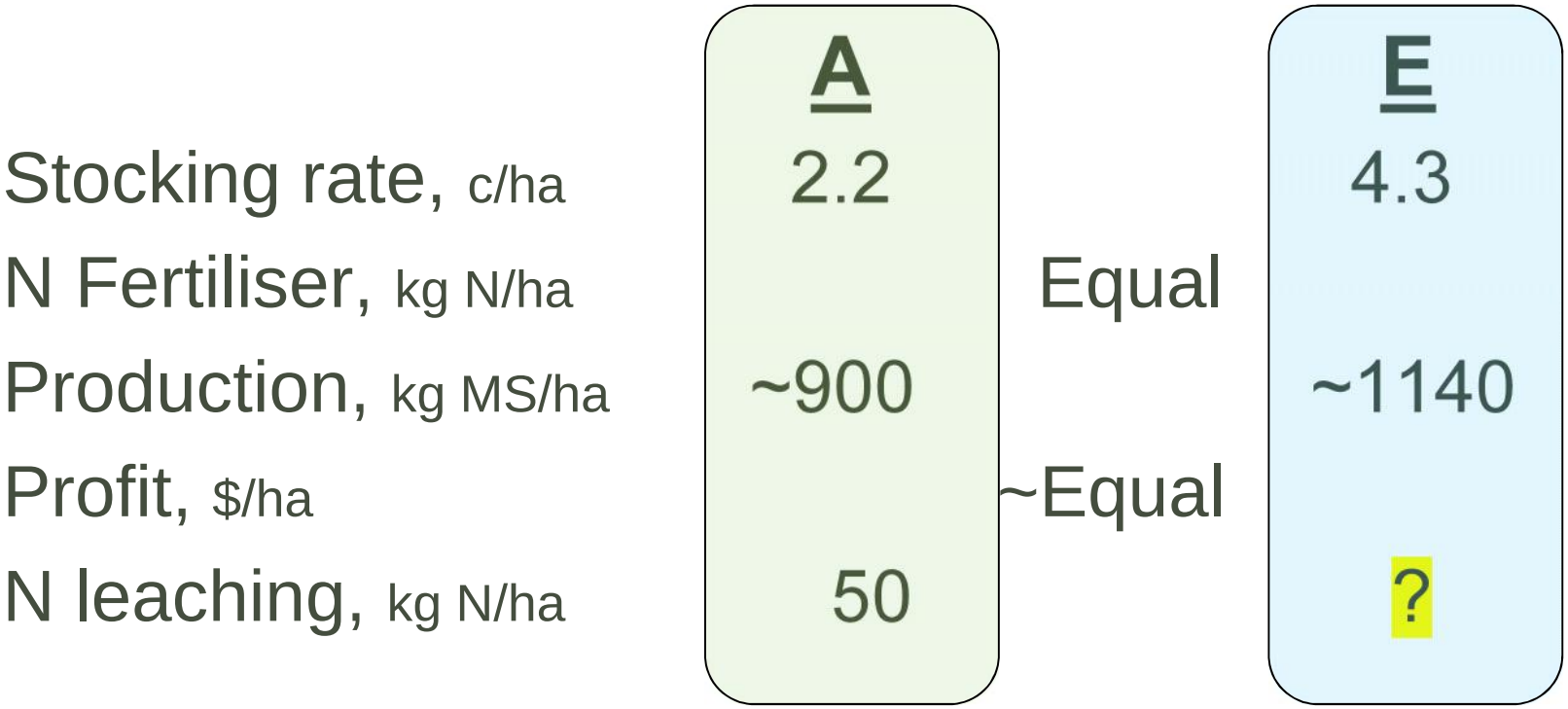
- The Government needs to set "appropriate limits on fertiliser application and stock levels"
  - Labour Party water and environment spokesman David Parker

June 28, 2016. Stuff.co.nz

Simple Production function

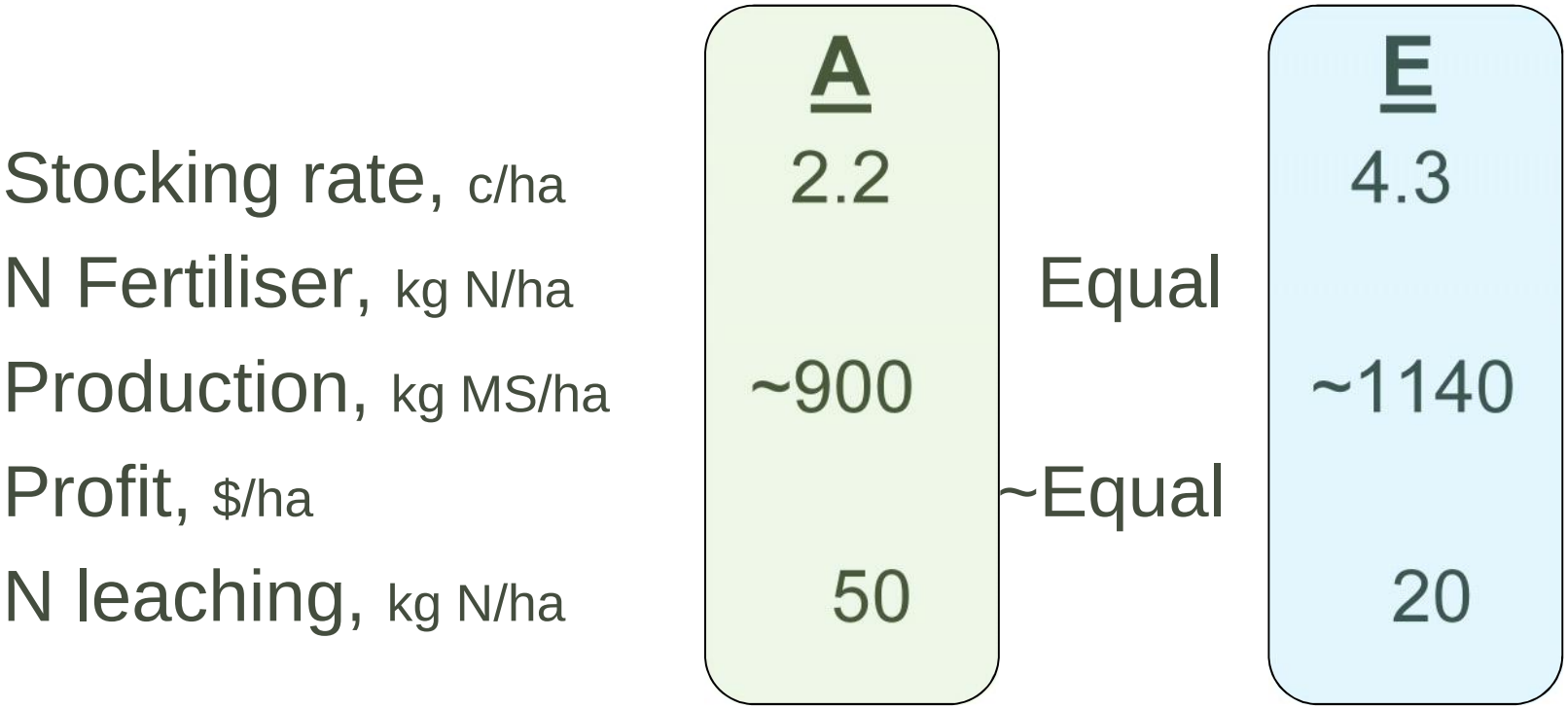


Stocking rate farmlet trial



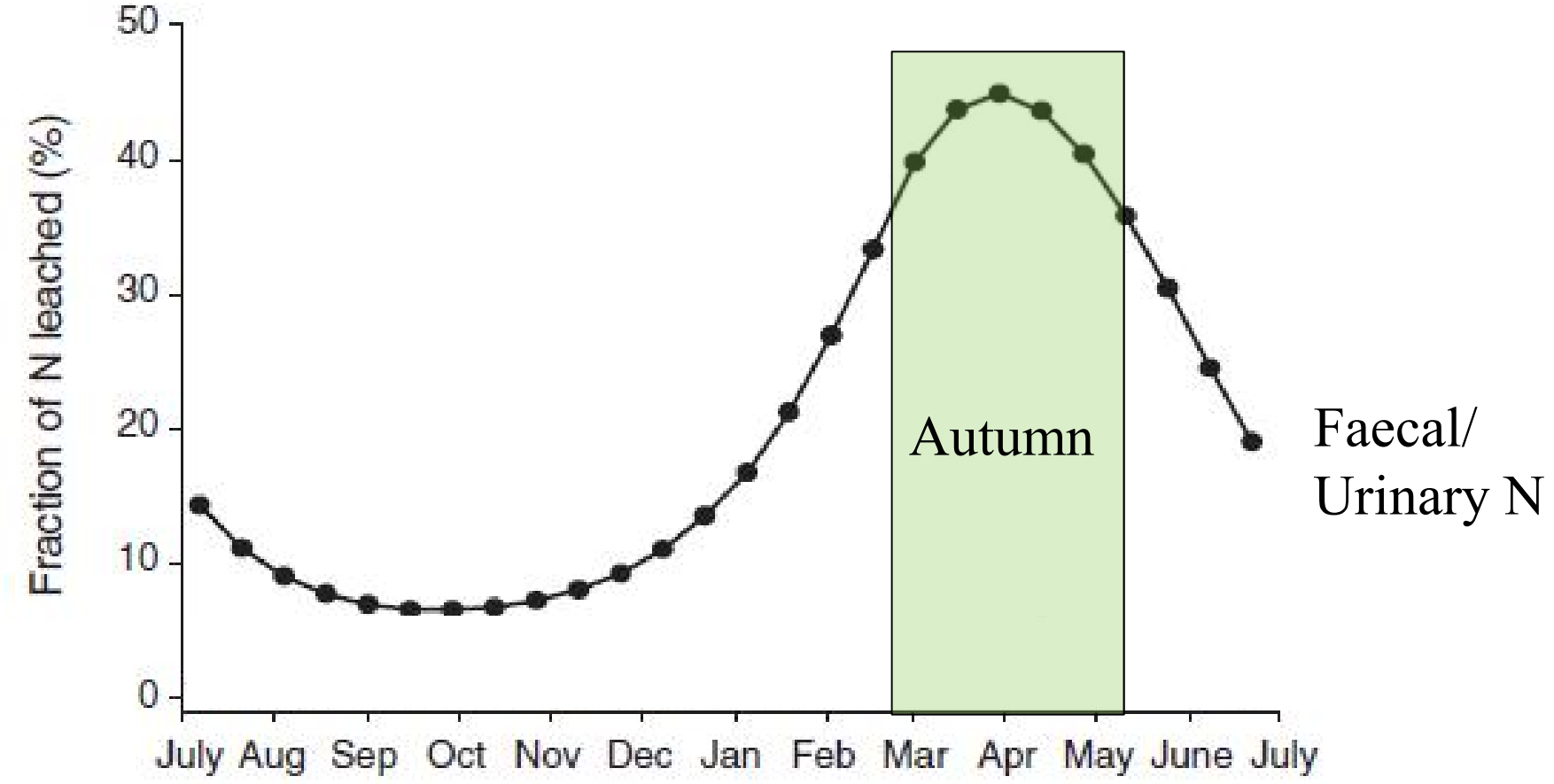
Roche et al., 2016

Stocking rate farmlet trial



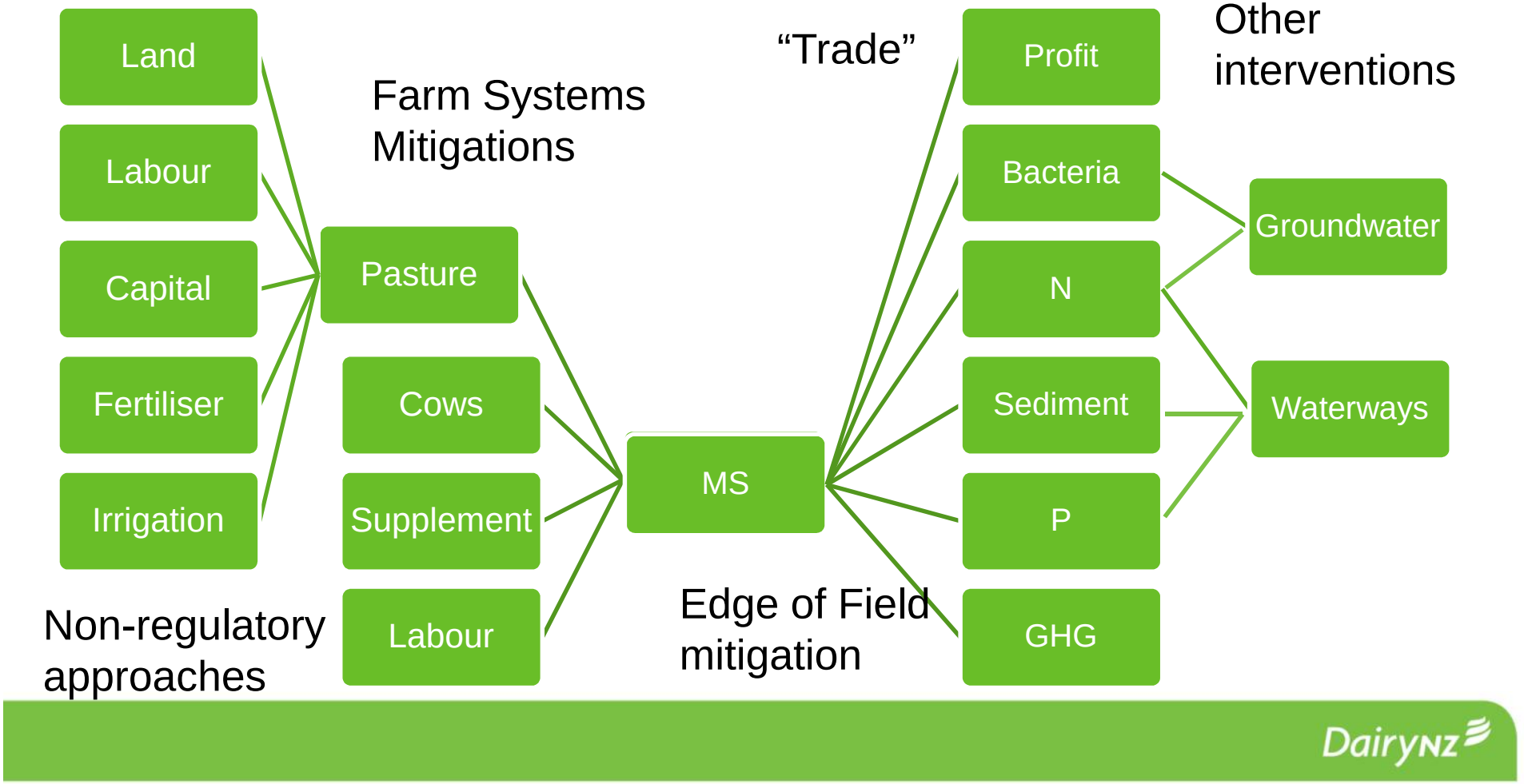
Roche et al., 2016

Likelihood of N loss



Romera and Doole, 2015

Actual Production function



Efficiency

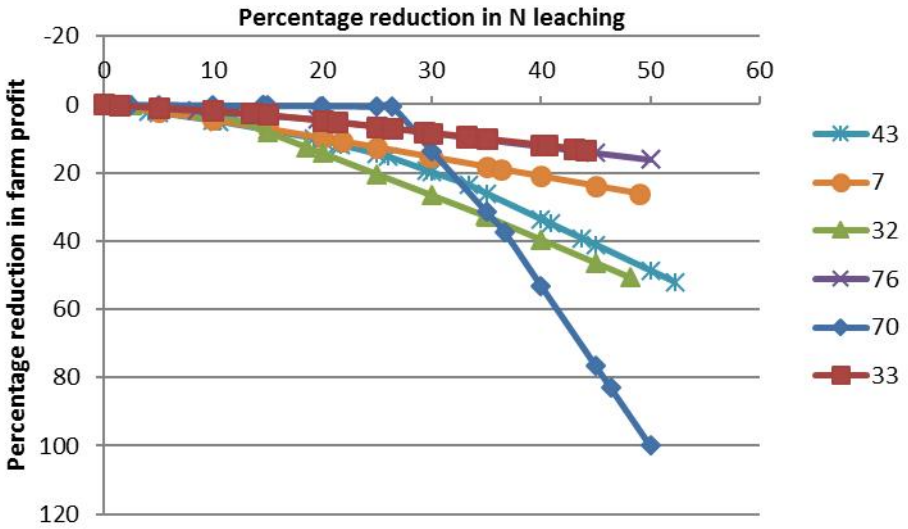
- Resource availability
- Managerial ability
  - Graze at 2 vs 3 leaf (Chapman et al.)
  - No feed wedge, fast rotation vs slow rotation (Bryant et al.)
- Future
  - New plant breeds

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

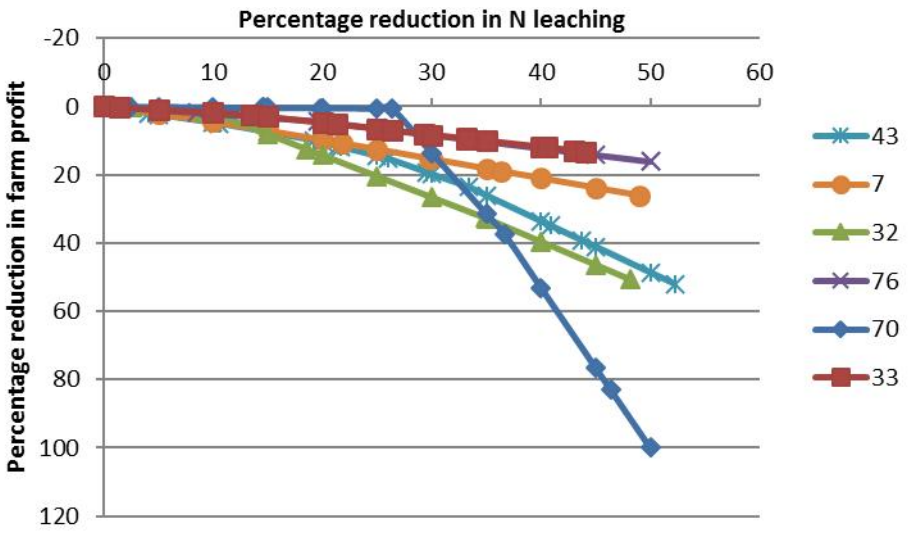
Abatement curves

Percentage

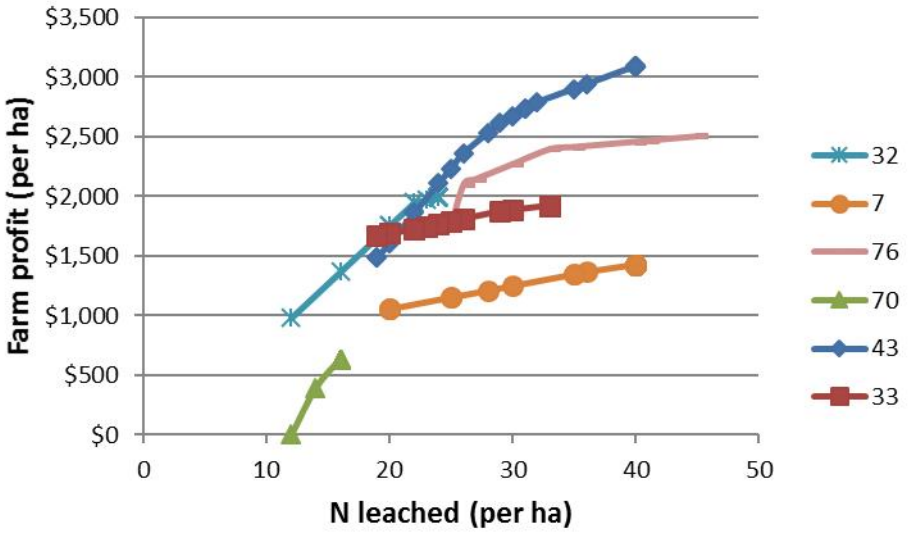


Abatement curves

Percentage

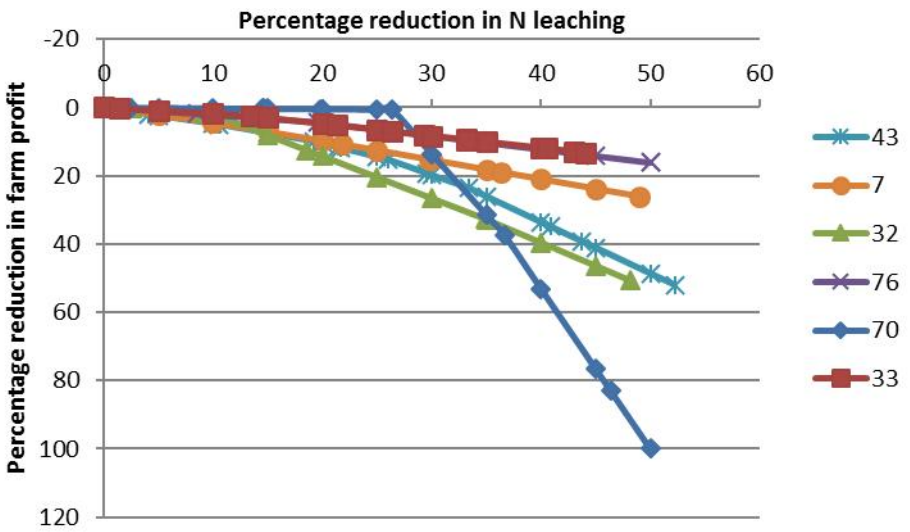


Absolute



Abatement curves

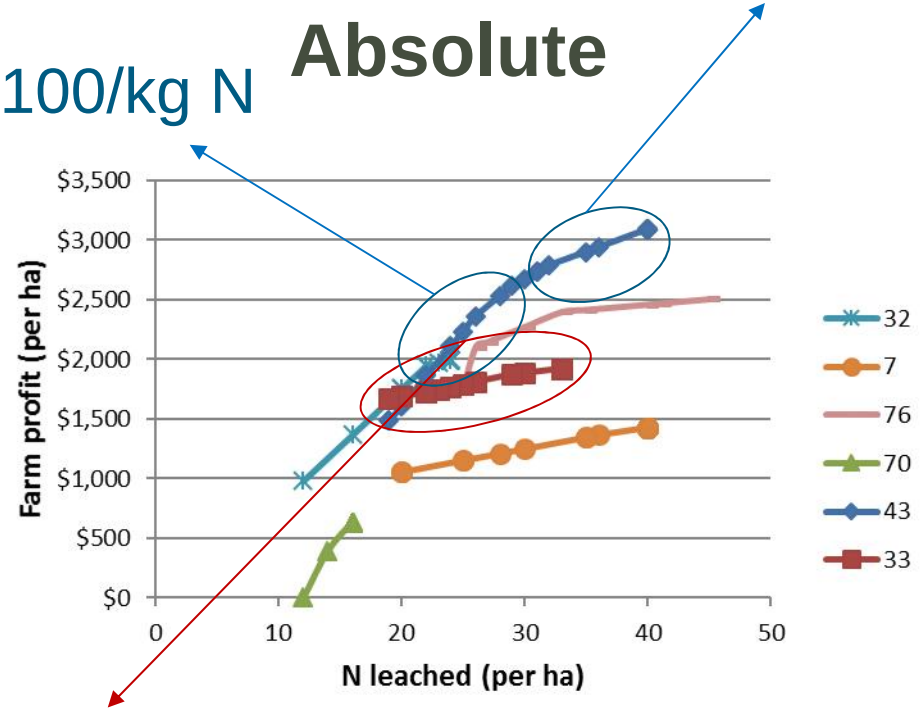
Percentage



Absolute

$40/kg N

$100/kg N

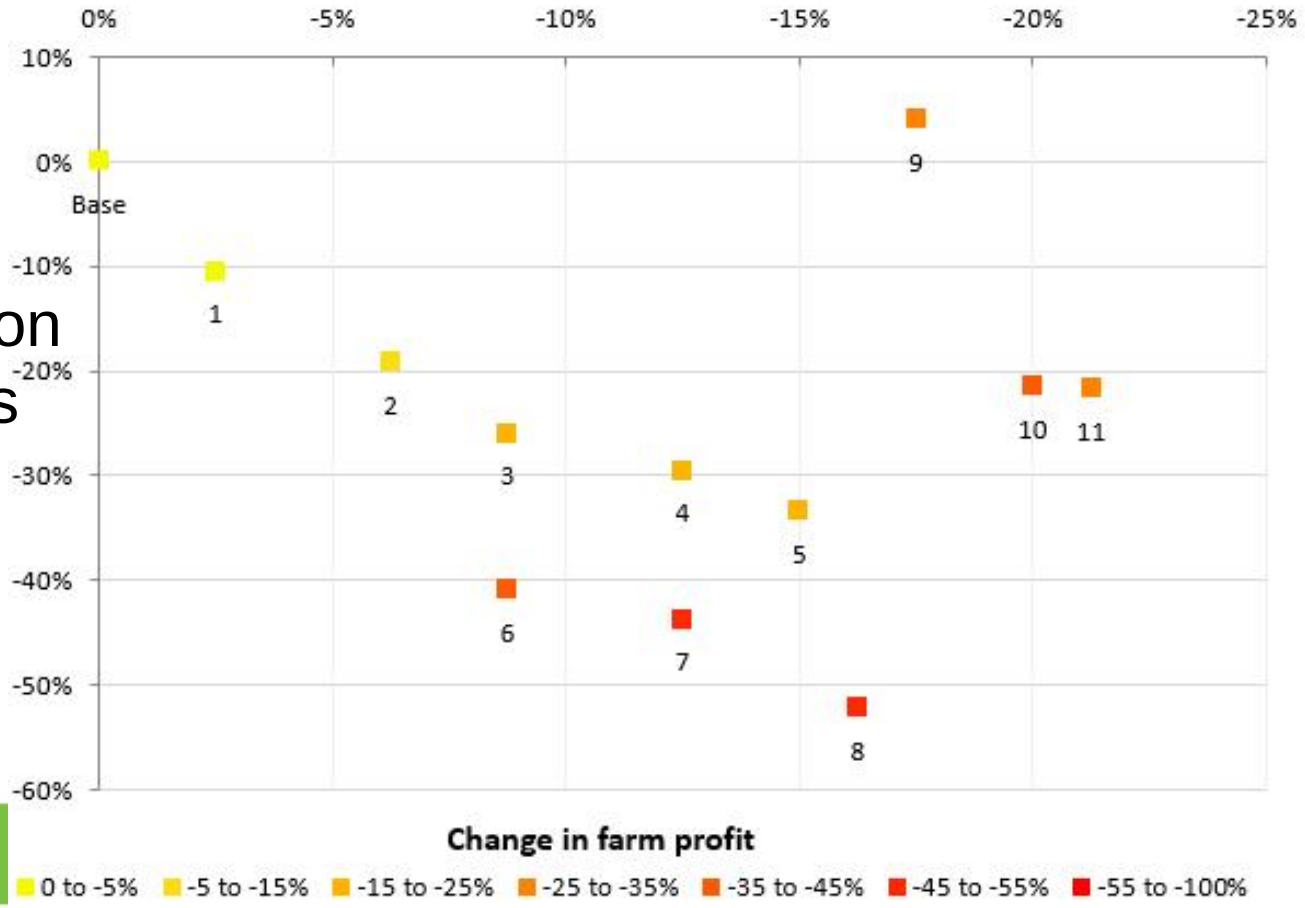


$20/kg N

N mitigation vs P mitigation: FSM

Reduction in P loss

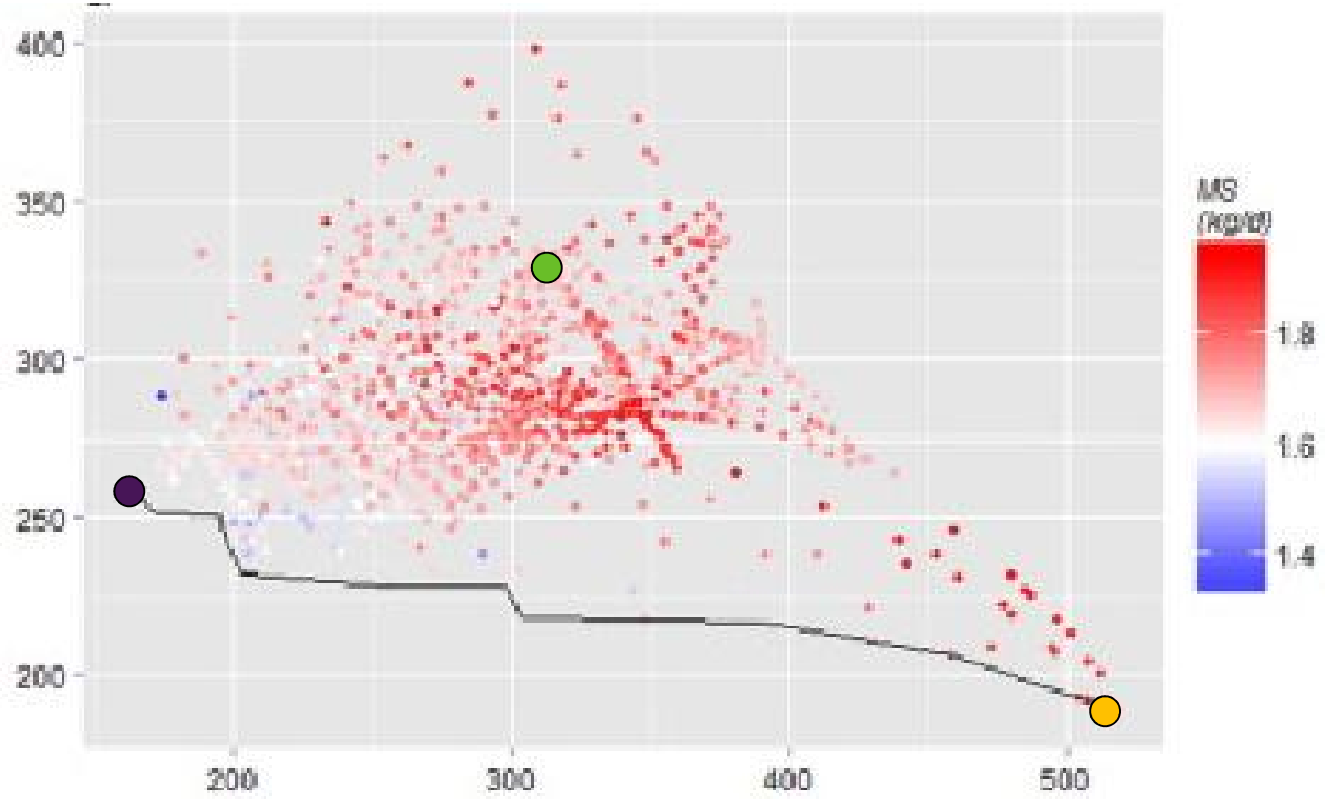
Reduction in N loss



DairyNZ

N mitigation vs GHG mitigation: Diet

CH4



Gregorini et al. 2016

Urinary N

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%

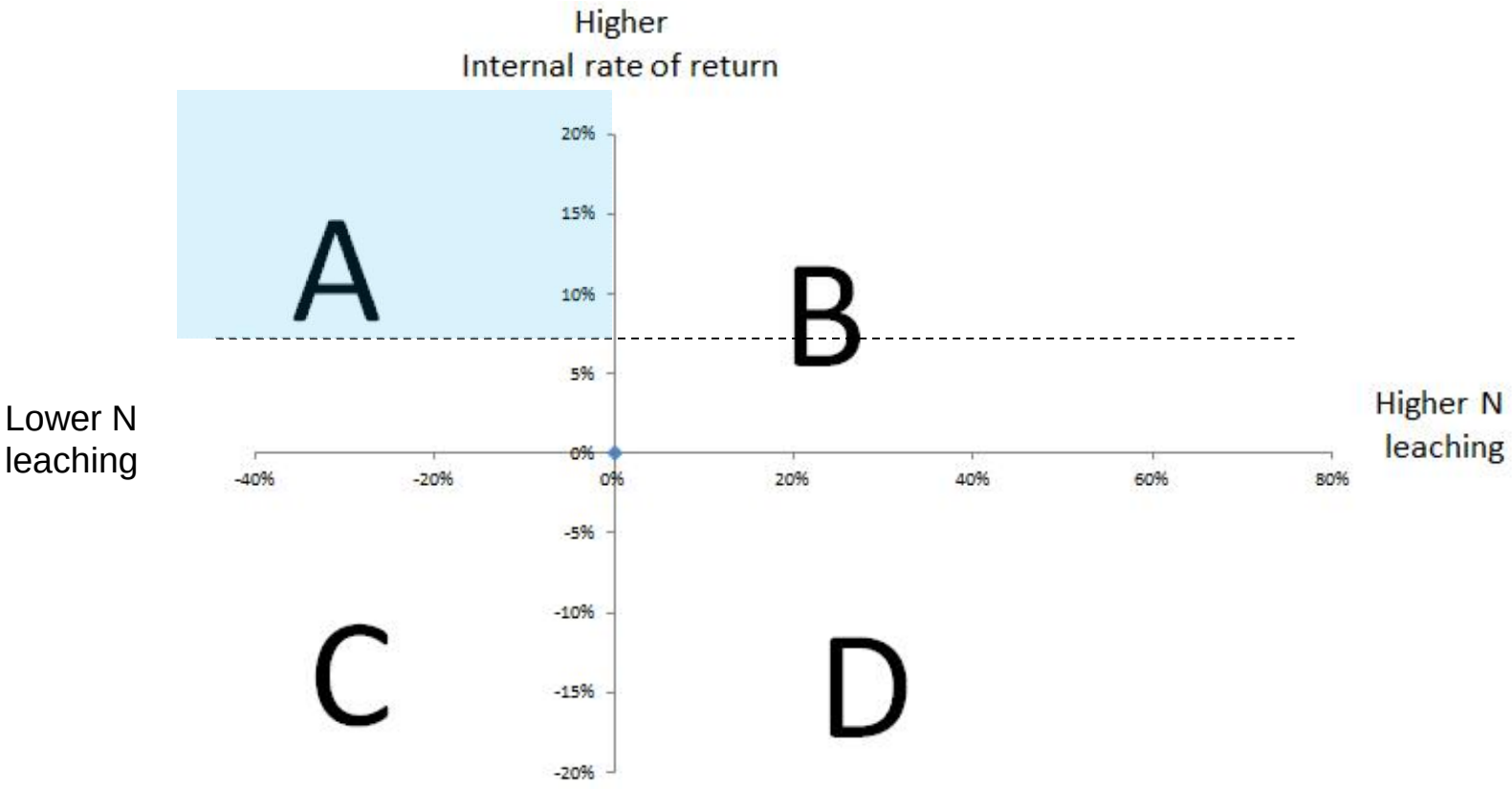
Coase and property rights

- 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

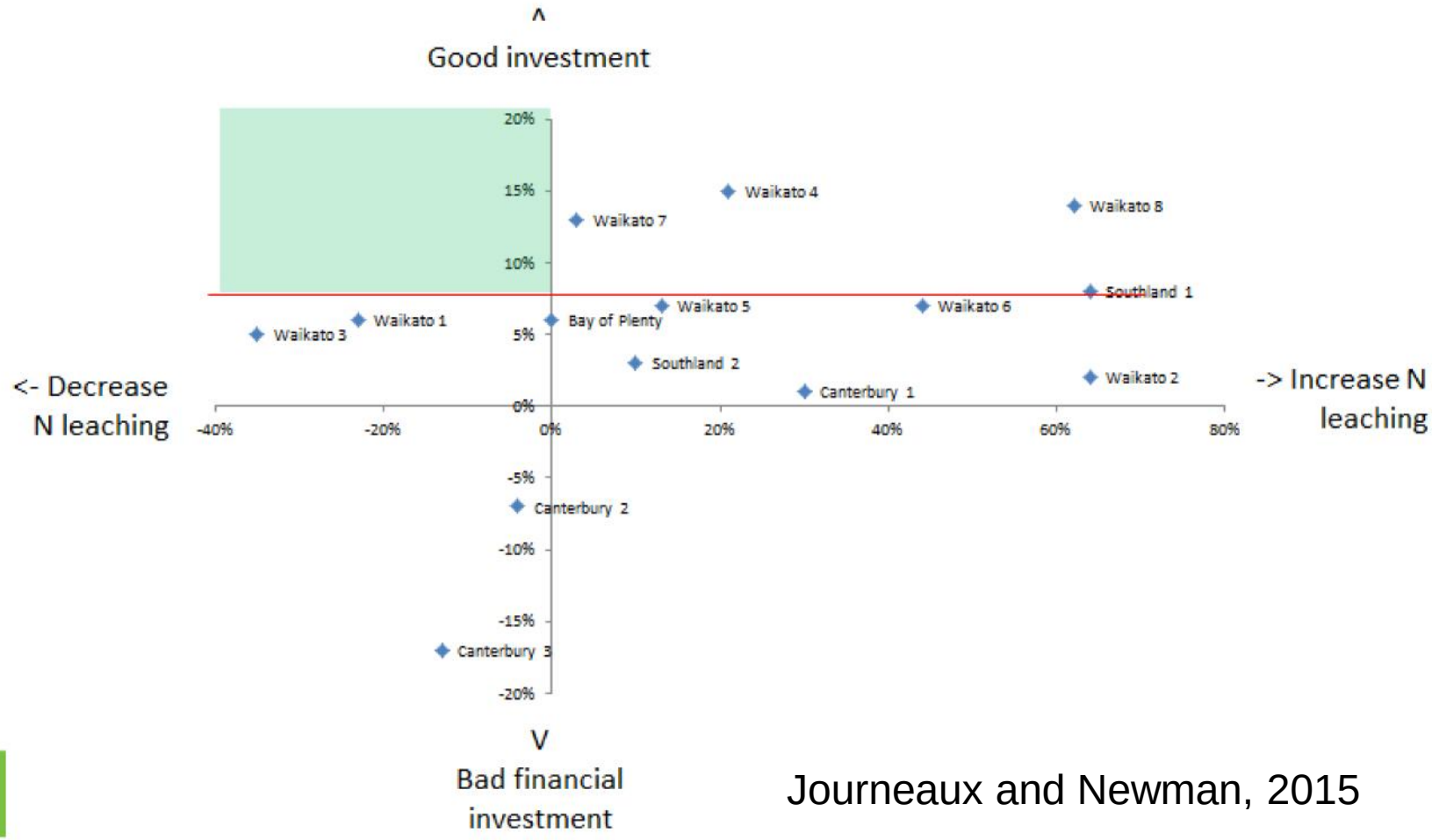
Barns



Journeaux and Newman, 2015

DairyNZ

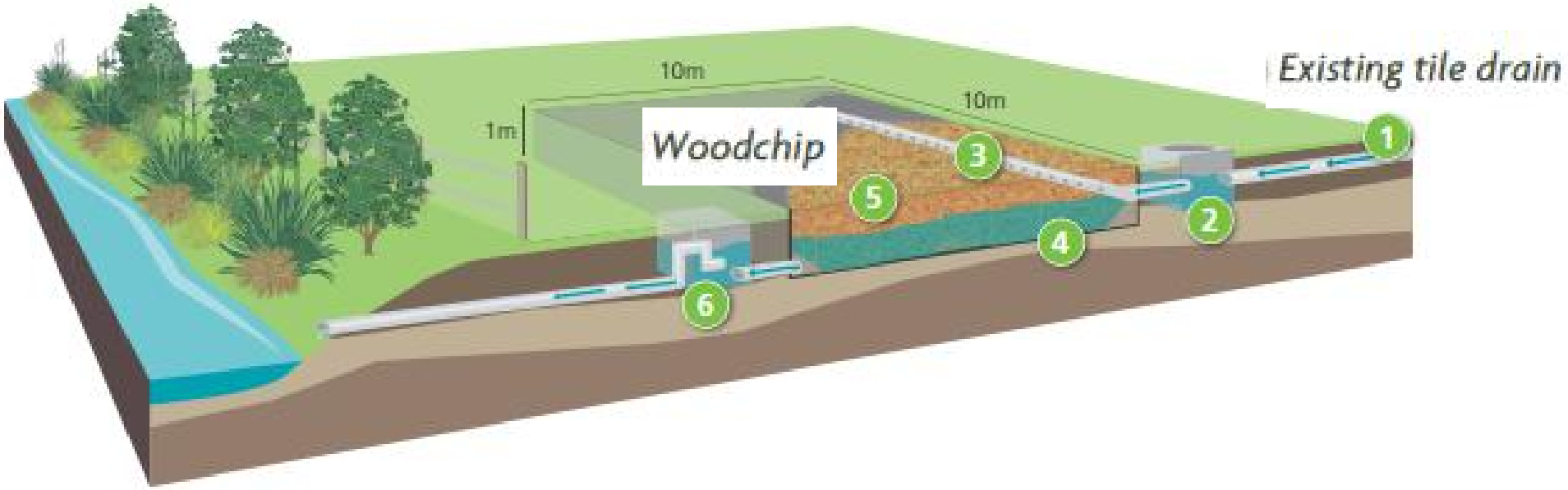
Barns



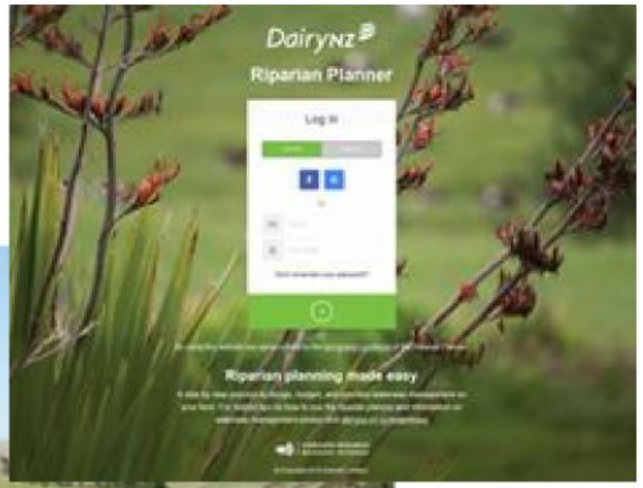
Journeaux and Newman, 2015

Artificial wetlands

Nitrate Catcher



Riparian planting

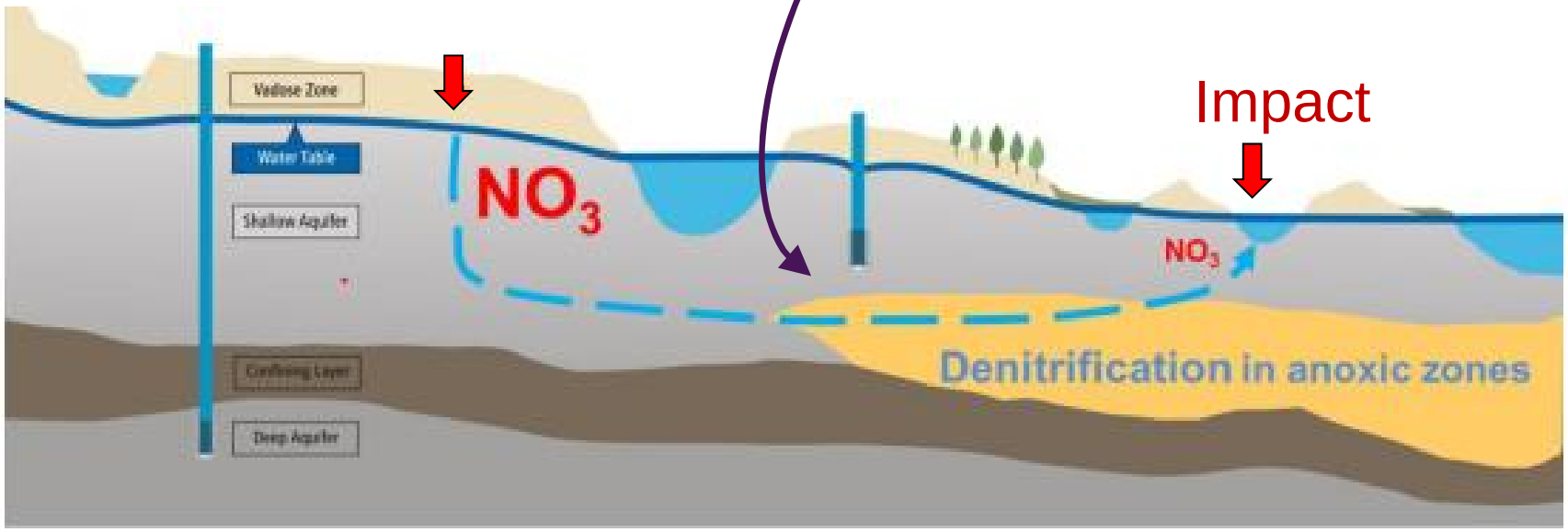


Aquifer recharge

Attenuation

Distance,
Time lag,
Denitrification potential

Farm N loss



Sustainable milk plans

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

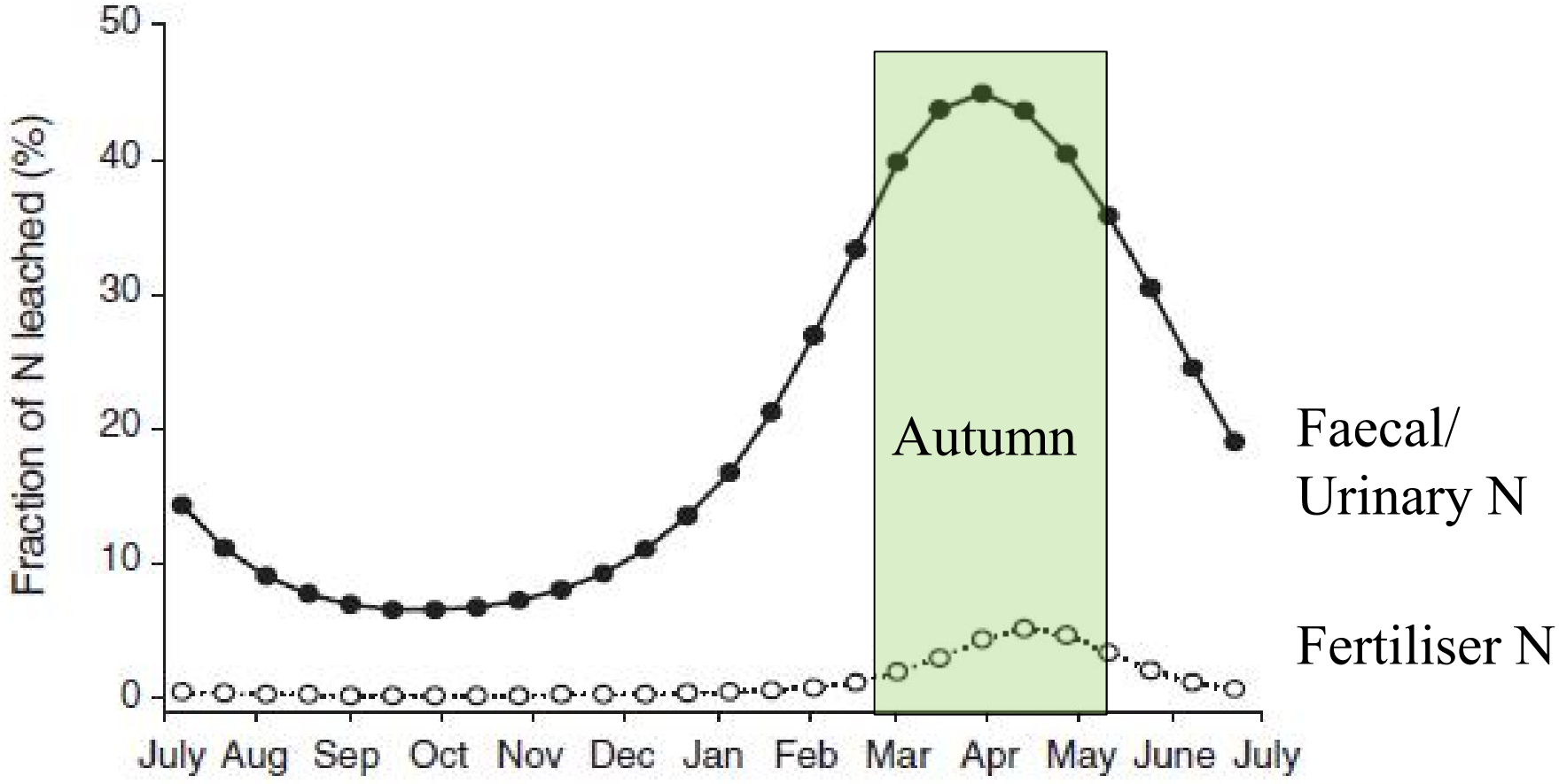
Good Management Practice

- 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



Romera and Doole, 2015

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?