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Allowance allocation in nutrient markets with heterogeneous farmers

The Lake Rotorua catchment

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Objective

- Model the impact of two alternative nutrient allowance allocation approaches for the Lake Rotorua catchment using the NManager model
  - Sector-based averaging
  - Grandparenting
- Cap on agricultural nutrient losses in 20 years: 256 tonnes N/year (current losses of 526 tN/year)
- Focus on effects of farm heterogeneity

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Outline

- Main points
- Background on the NManager model
- A few notes on methodology
- *Preliminary* results
  - Cross-sectoral results
  - Impacts of allocation within sectors
- Summary

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Main points

- The choice of allocation approach does not matter for cost sharing across the sectors
- The choice of allocation approach matters greatly for cost sharing within each sector
- The grandparenting approach tends to ease the burden on those who mitigate more
- The source of variation in benchmarked nutient losses should be of interest to policy makers

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NManager

- Simulation-based optimisation model of water quality policy (not farm management model)
- Profit functions quadratic in nutrient discharge (*N*)

$$Profit = a\,N^2 + bN + c$$

- Simplified view of farms
- Desirable properties, but not fully flexible
- NManager determines market price of allowances from demand and supply (cap)

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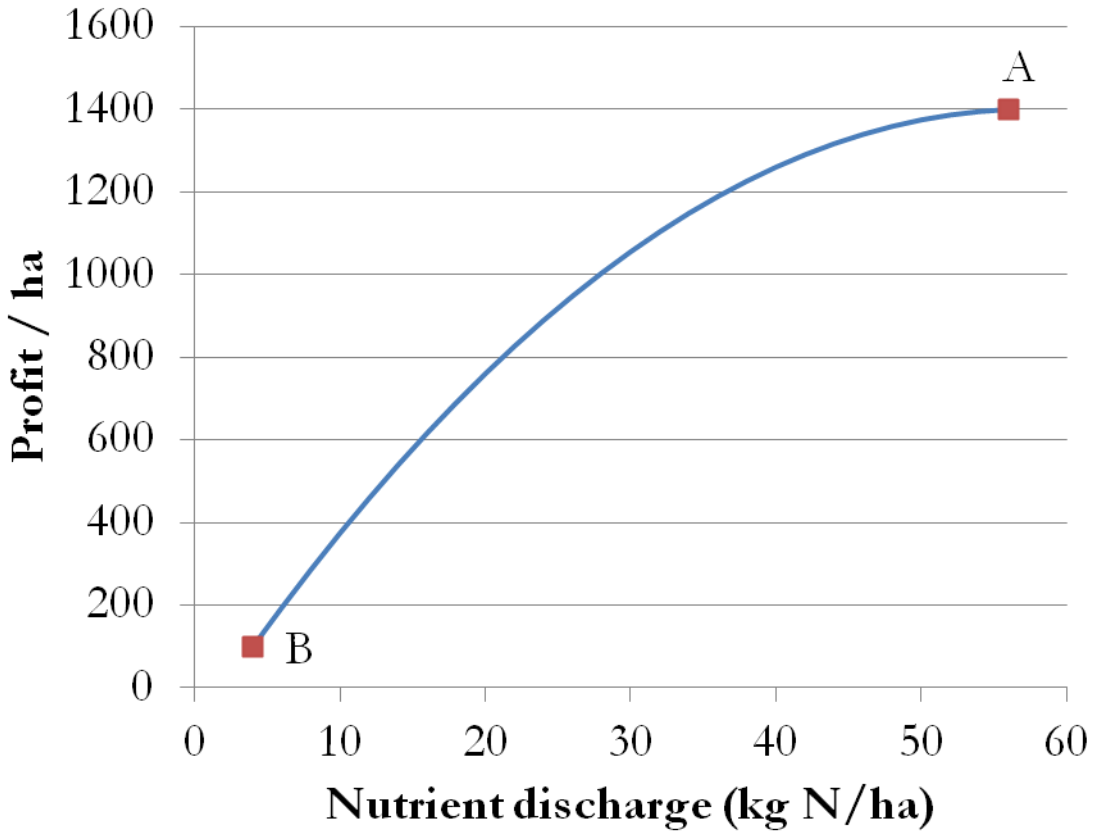
Profit functions



- Higher intensity raises profits, but…
- at a decreasing rate
- Increasing marginal cost of mitigation
- Smoothness

Data

- Farm-specific Overseer results from BoPRC
- Previous research

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Cross-sectoral results (year 20)

Sector	Dairy		Drystock	
	total	per ha	total	per ha
Area (ha)	5,492		13,987	
Nutrient loss (kg N/year)	232,737	42.38	292,716	20.93
Mitigation (kg N)	99,583	18.13	170,321	12.18
Estimated baseline profit ($)	5,107,532	929.94	5,789,533	413.93
Mitigation cost ($)	791,884	144.18	1,416,901	101.30
Net allowance cost ($)	347,834	63.33	-347,355	-24.83
Total cost ($)	1,139,718	207.51	1,069,546	76.47

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Cross-sectoral results (year 20)

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Mitigation (kg N)	99,583	18.13	170,321	12.18
Estimated baseline profit ($)				
Mitigation cost ($)		++		++
Net allowance cost ($)		+		-
Total cost ($)		+++		+

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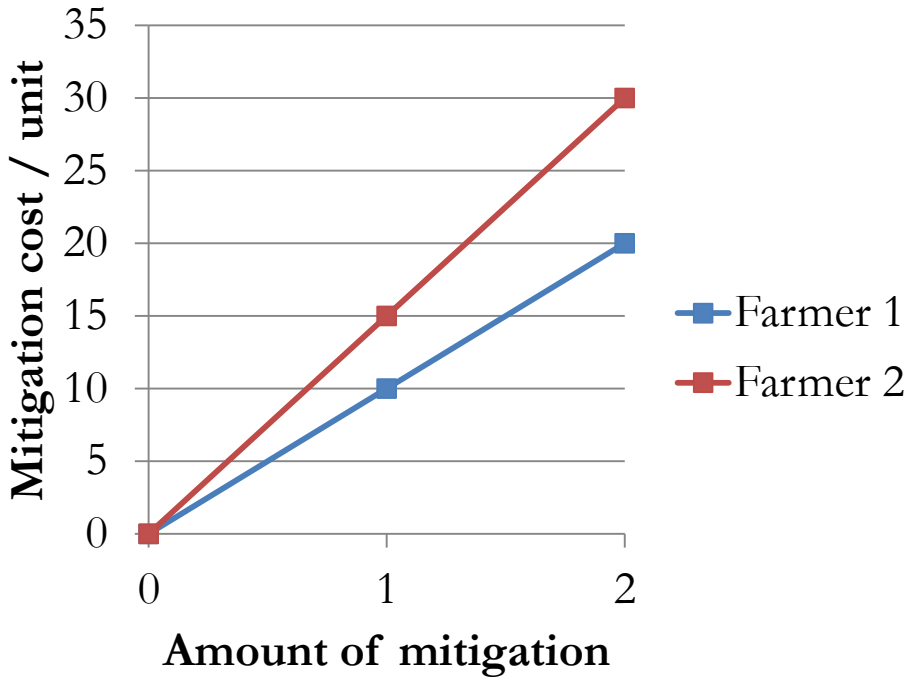
Cross-sectoral results (year 20)

- These outcomes are identical across the two allocation scenarios because both are based on
  - Identical nutrient caps
  - Free trade in allowances
  - The same allocation to each sector



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Allocation impacts

- Who is affected?
  What types of farmers gain of lose from one allocation method relative to the other?

- How are they affected?
  How does allocation affect cost sharing within the sectors?

- Why are they affected?
  And what are the implications?

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Who is affected?

Farmer	Nutrient loss	Allowances		
		SA	GP	SA-GP
Farmer 1	10	10	5	5
Farmer 2	20	10	10	0
Farmer 3	30	10	15	-5
Total	60	30	30	0

- High baseline N: higher allocation under GP
- Low baseline N: lower allocation under GP

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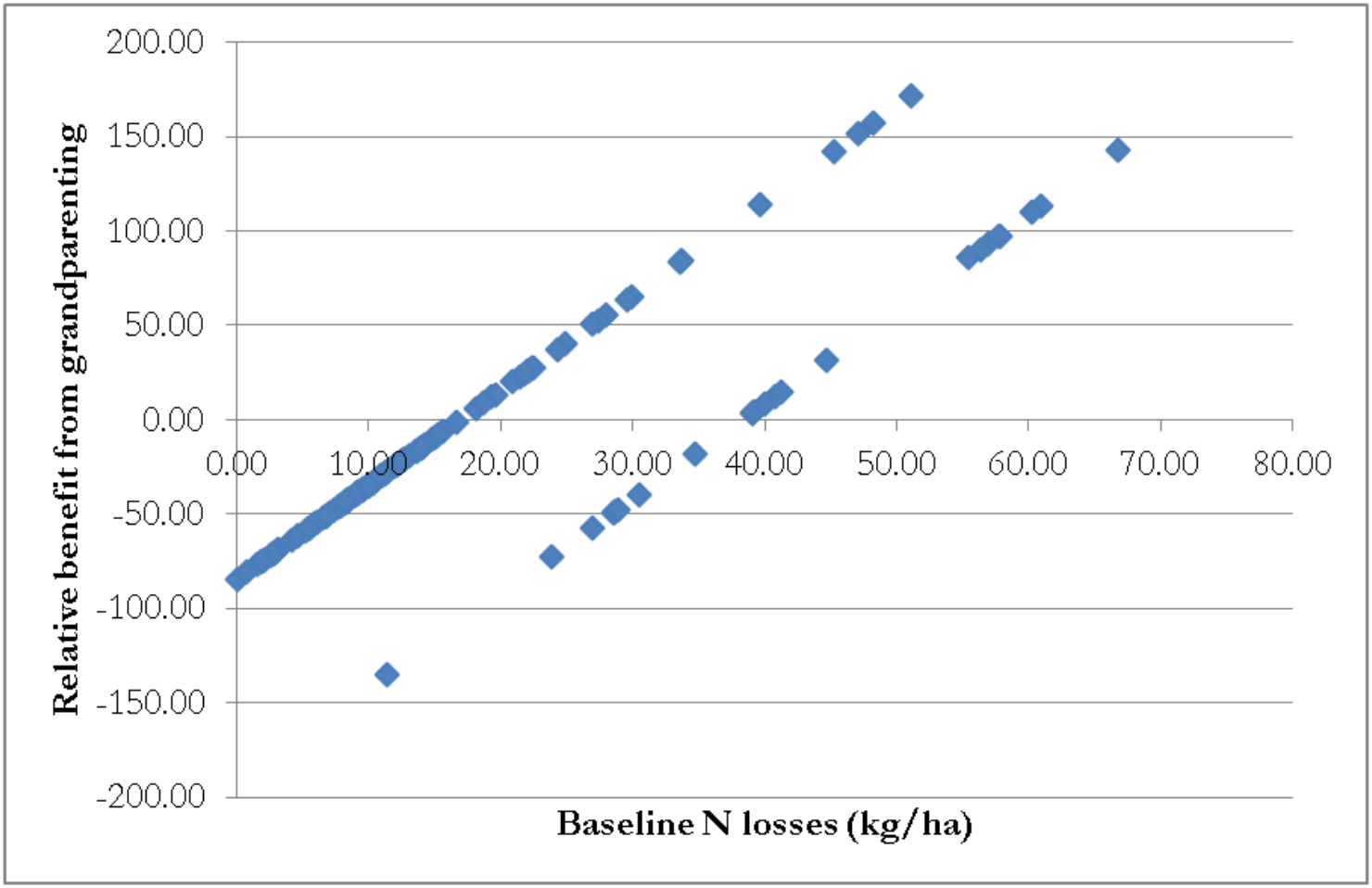
Who is affected?



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How are they affected?

- The broad picture: how does this affect cost sharing within each sector?

Total cost = mitigation cost +
net cost of allowances traded –
value of free allocation

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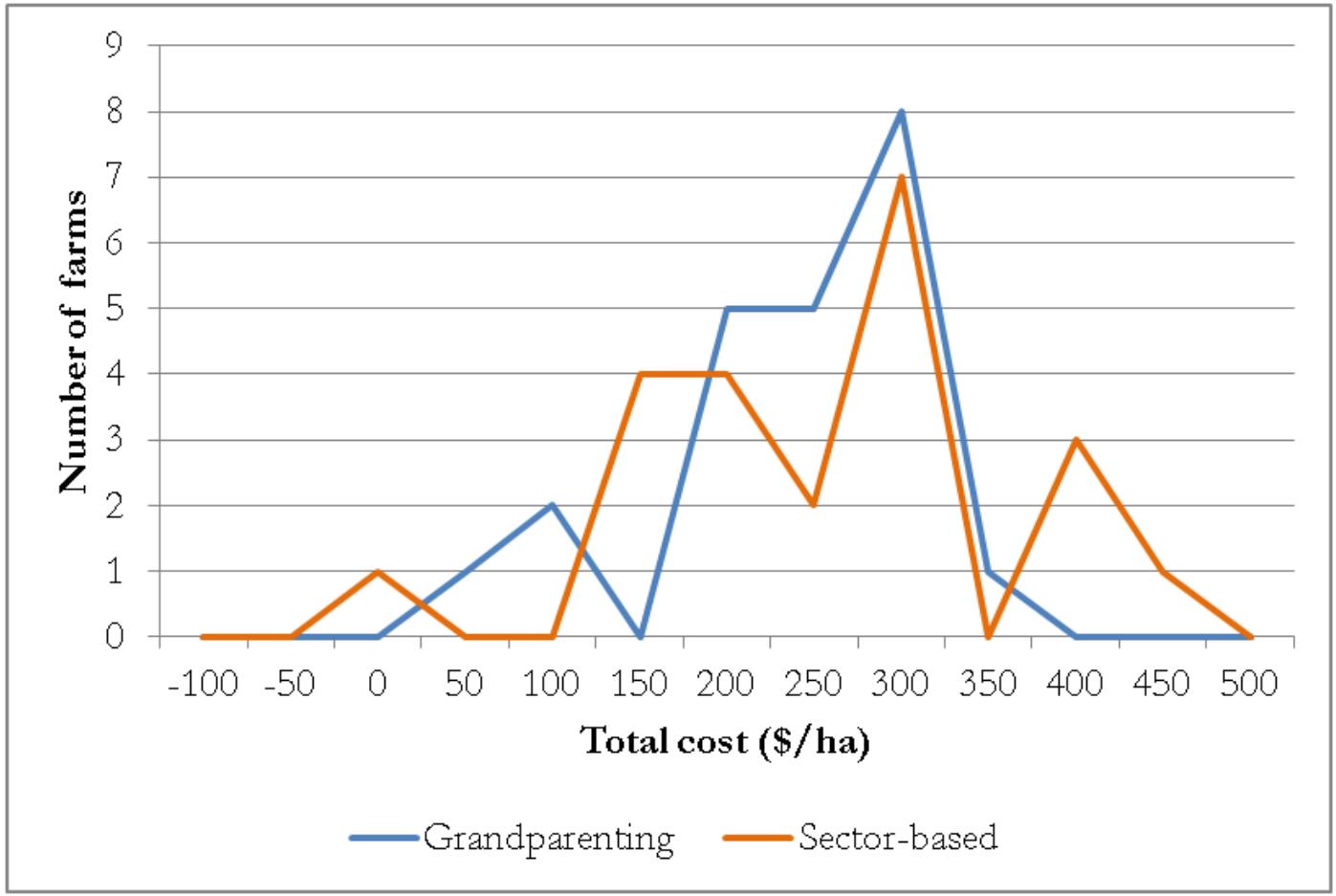
How are they affected?

Dairy



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How are they affected?

Dairy

- The grandparenting approach tends to ease the burden on those who mitigate more

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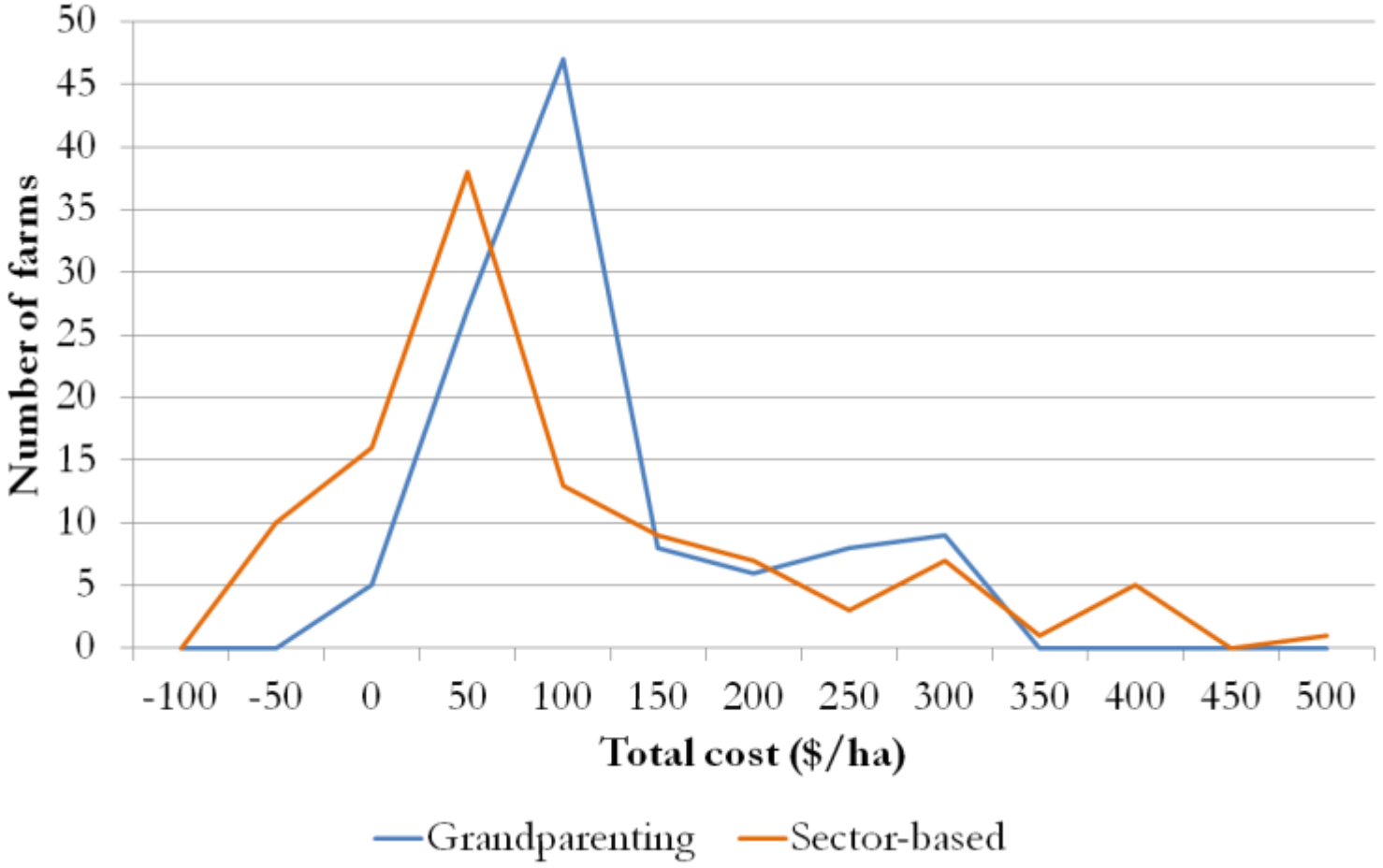
How are they affected?

Drystock



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Why are they affected?

- Question is akin to asking why benchmarked nutrient losses differ across farms
- What is the source of variation in benchmarked nutrient losses?
- Why does this matter?

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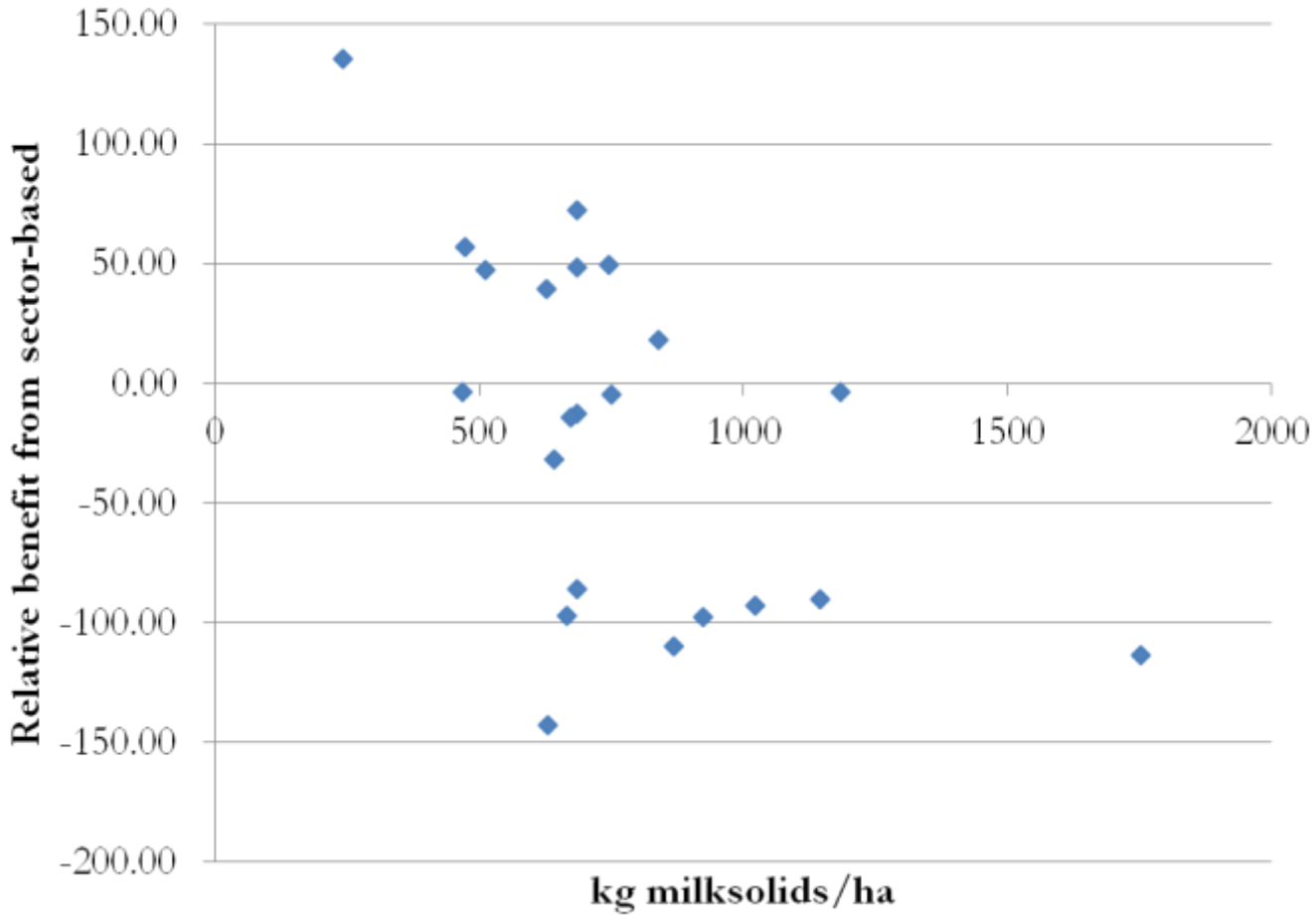
Why are they affected?



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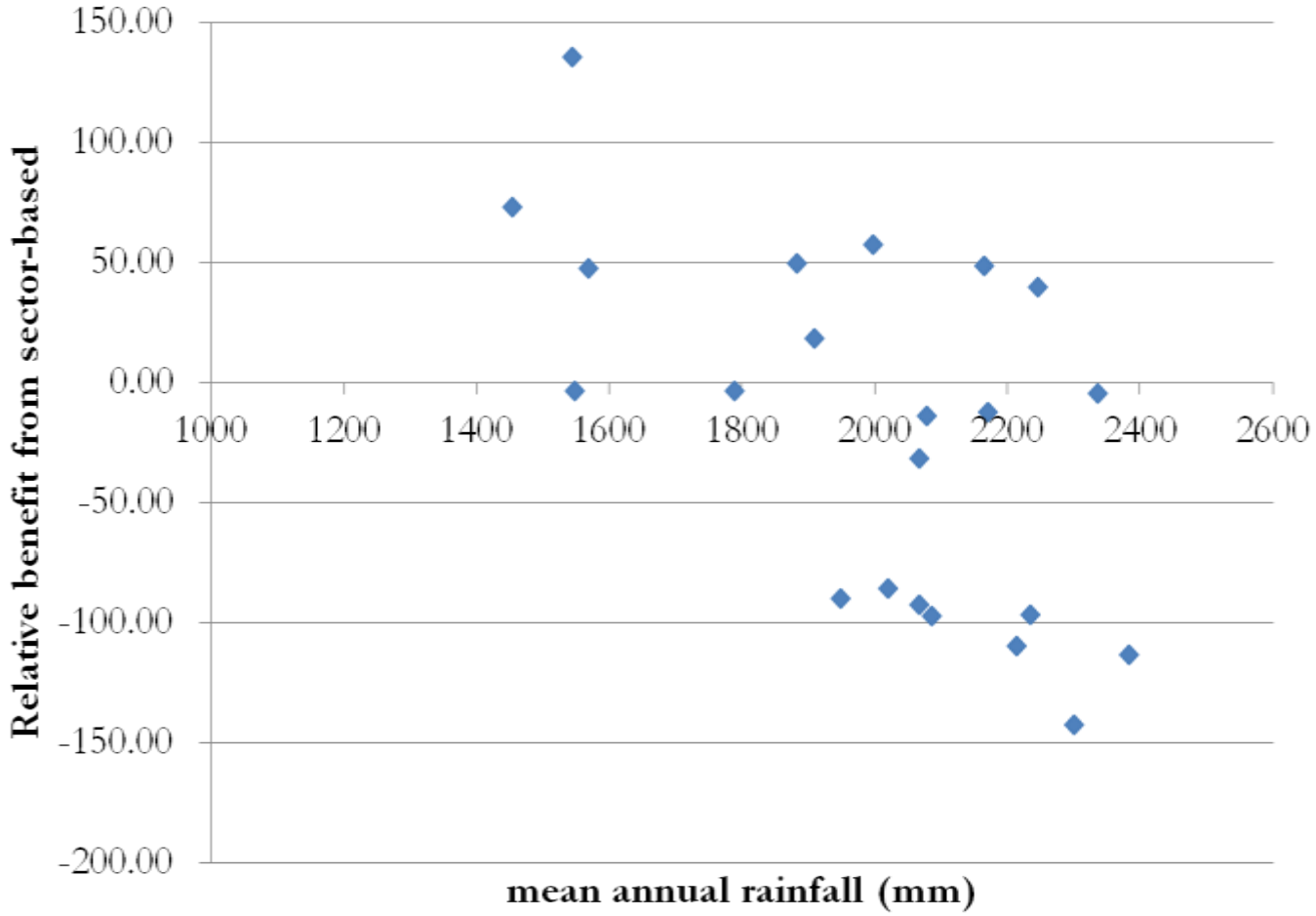
Why are they affected?



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Policy implications

- Benchmarked nutrient losses may differ due to
  - Farm management practices
  - Geophysical factors outside the farmer's control
- Argument for sector-based averaging: it rewards past mitigation and more sustainable farming practices
- Argument for grandparenting: does not disadvantage farmers who have high rates of baseline nutrient loss due to factors outside their control

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Policy Implication

- Which allocation is “better”?
- Political desirability should depend on balance of factors that determine baseline nutrient losses
  - Sector-averaging: if farm management more important
  - Grandparenting: if exogeneous factors more important
- Grandparenting some portion of allowances may be justified to ease the burden on farmers who happen to own land that is more prone to high nutrient loss

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Summary

- The choice of allocation approach does not matter for cost sharing across the sectors
- The choice of allocation approach matters greatly for cost sharing within each sector
- Grandparenting tends to ease the burden on those who mitigate more, but does not reward past mitigation
- The source of variation in benchmarked nutrient losses should be of interest to policy makers
- Calibrating allocation to geophysical factors could be desirable

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