Nitrogen Leaching & GHG Emissions

Critical Pathways Programme

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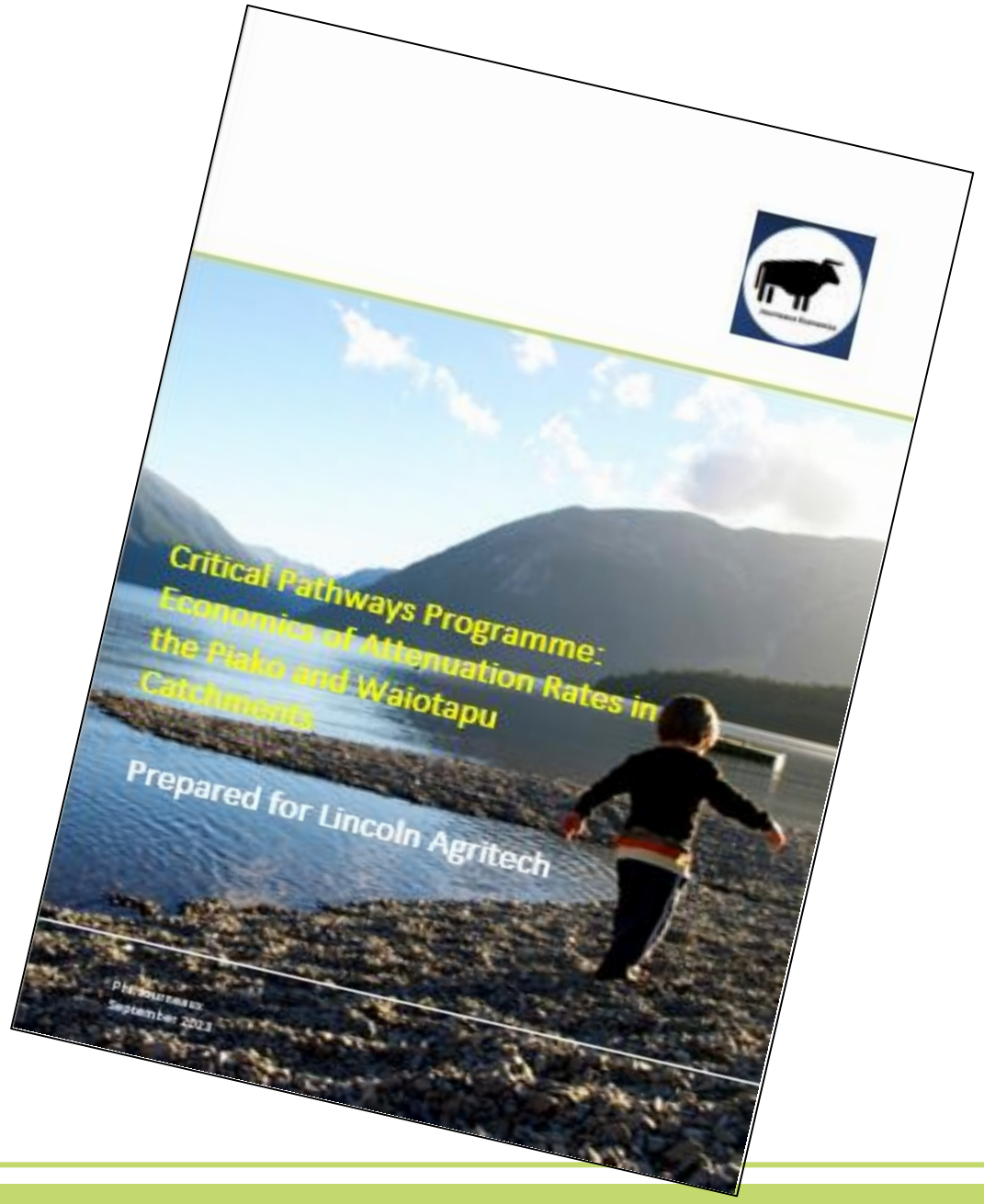
There is a report:

https://lincolnagritech.co.nz/wp-content/uploads/2023/12/Economics-of-Attenuation-Rates-in-the-Piako-and-Waiotapu-Catchments.pdf



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Objectives

- To model the nitrogen loading from farms
- To consider the economic cost of reducing N loading
- To consider greenhouse gas implications & the relationship between GHG & N leaching mitigation
- To calculate the net benefit of reducing nitrogen yields into groundwater

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Farm Modelling

- Done via Farmax and Overseer
- 5 farms modelled in Piako, 6 in Waiotapu
- Various scenarios modelled, to compare the results against the base farm
- N attenuation rates based on 3-year measurements by Lincoln Agritech

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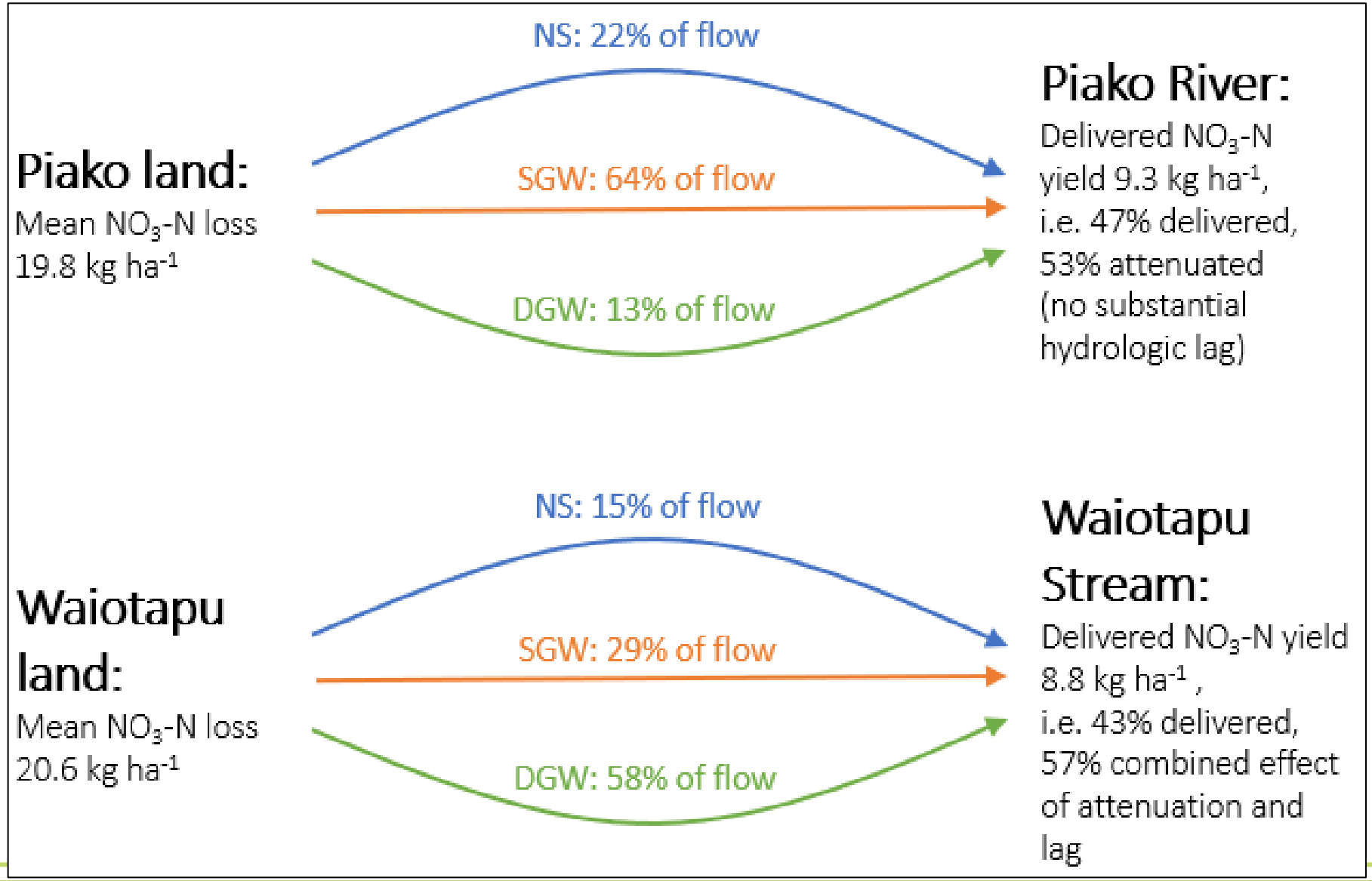
Catchment Level NO_3-N Yields



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Results: Waiotapu (weighted average)

	EBITDA ($/ha)	% Reduction relative to base	N loss (kg N/ha)	% Reduction relative to base	GHG Emissions (T CO_2e/ha)	% Reduction relative to base
Base	$4,539		46		10.6	
No N Fertiliser	$4,125	-9%	36	-22%	9.3	-12%
$^1/_2$ Supplements	$4,251	-6%	47	1%	10.4	-2%
Reduce SR 10%	$4,446	-2%	43	-6%	9.9	-6%
Wintering Pad	$4,385	-3%	42	-9%	10.7	1%
SR10 + Pad	$4,292	-5%	39	-15%	10.0	-5%

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Results: Piako (weighted average)

	EBITDA ($/ha)	% Reduction relative to base	N loss (kg N/ha)	% Reduction relative to base	GHG Emissions (T CO_2e/ha)	% Reduction relative to base
Base	$3,048		23.2		8.3	
No N Fertiliser	$2,874	-6%	19.8	-15%	7.2	-13%
$^1/_2$ Supplements	$2,911	-4%	23.7	2%	8.2	-2%
Reduce SR 10% (SR10)	$3,326	9%	22.6	-2%	8.0	-3%
Wintering Pad	$2,888	-5%	21.4	-8%	8.5	2%
SR10 + Pad	$3,166	4%	20.7	-11%	8.2	-2%

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Influence of Attenuation Rates

	Scenario#1			Scenario#2	
	Before	After		Before	After
Kg N/ha loss (load)	30	25		30	25
Attenuation	40%	40%		60%	60%
N lost to attenuation (kg N/ha)	12	10		18	15
Delivered load (to water - kg N/ha))	18	15		12	10
Farm EBITDA ($/ha)	$3,500	$2,500		$3,500	$2,500
Cost to reduce N loss ($/kg N)		$333			$500

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Cost Benefit Analysis

Slight problem – could cost the N loss, but no data/value on the benefits

Used Marsh (2010) as a proxy – choice modelling on WTP to improve WQ of Karapiro & Arapuni hydro lakes (WTP/household = $86)

Scenario 1: Reduce N loading by 20%
Scenario 2: Reduce N loading by same absolute amount for both catchments

	Farm cost ($/ha)	NPV ($ million)	Breakeven WTP per Household
Scenario 1	-107	-285	311
Scenario 2	237	-763	688

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Key Lessons

(i) Data OK at a sub/catchment level, but not sufficient to do an analysis at a farm level

(ii) Possibly extrapolated to a regional level, but not to a national level

(iii) Possible to determine attenuation rates & put a cost on N leaching

(iv) The cost of reducing delivered N loads is very much driven by farm profitability, which varies widely from farm to farm

(v) Lag periods in N attenuation very important, & a methodology needs to be developed to differentiate lag times from attenuation rates

(vi) Cost/benefit analysis needs data on both sides of the equation

(vii) From a policy perspective – better value for money by concentrating on low attenuation catchments

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