Adaptation of water eutrophication indicators for European Product Environmental Footprinting of NZ products

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The Product Environmental Footprint scheme of the European Commission

The European Commission are heading towards environmental labelling that covers the whole life cycle of products

Product Environmental Footprint : describes the calculation "rules"

►16 impact categories (including eutrophication)

► Life Cycle Assessment is the reference method

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What is Life Cycle Assessment?

Eutrophication: one impact covered by LCA

"covers all **impacts** of excessively high environmental levels of macronutrients, the most important of which are **nitrogen (N) and phosphorus (P)**"

(Guinee et al. 2002)

But the indicator recommended by EC **focuses on P**

Although **N can also be a limiting factor…**

like in Lake Taupo

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Objectives

“Reconcile” freshwater eutrophication impacts LCA indicator (focusing on P), with local policy focusing on N
► **Adaptation of water eutrophication indicators for European Product Environmental Footprinting**

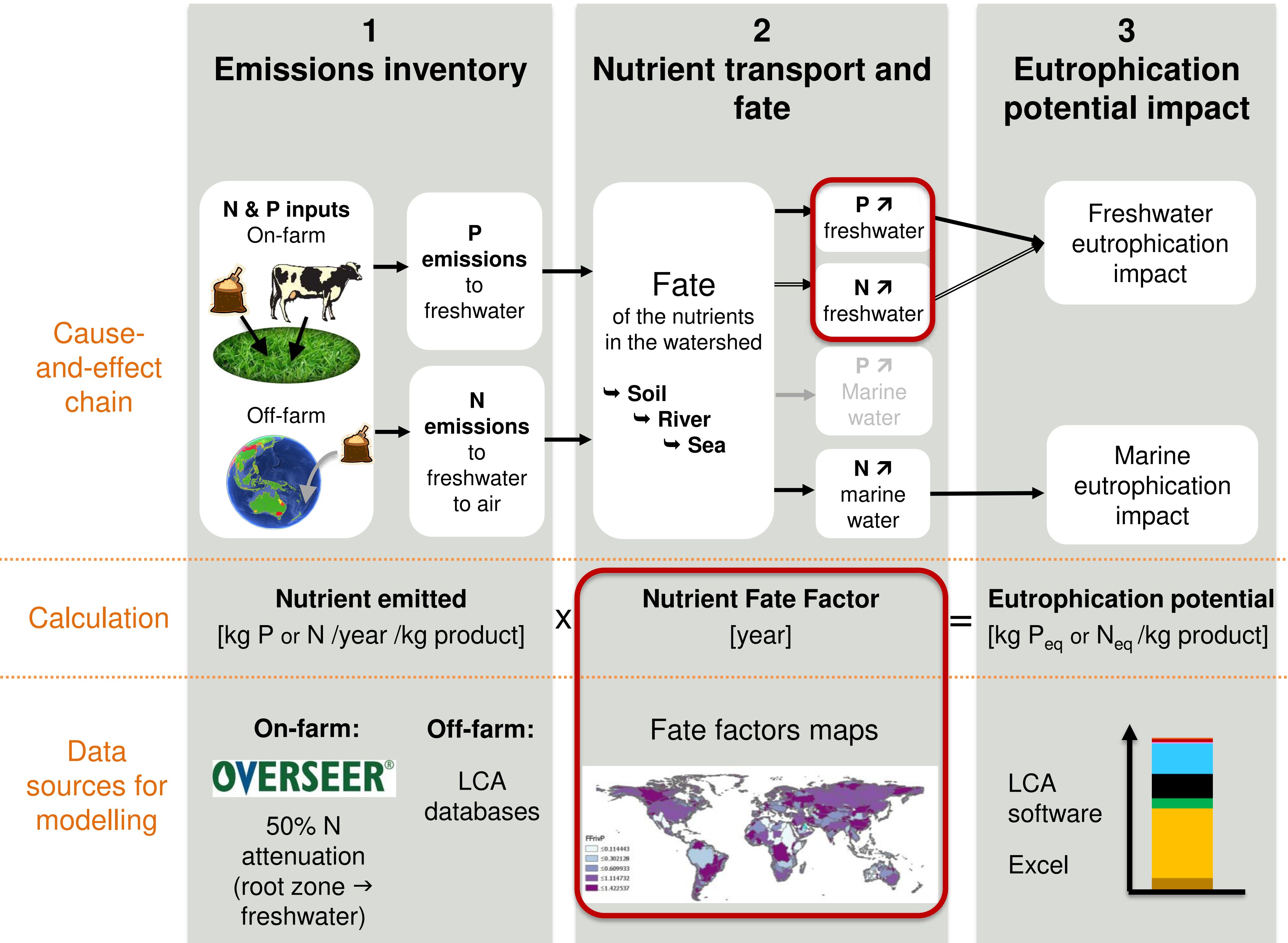
Case study on beef produced in Taupo exported to the European market:
► **Including environment, economics and potential price-premium**

Our (LCA) constraint:

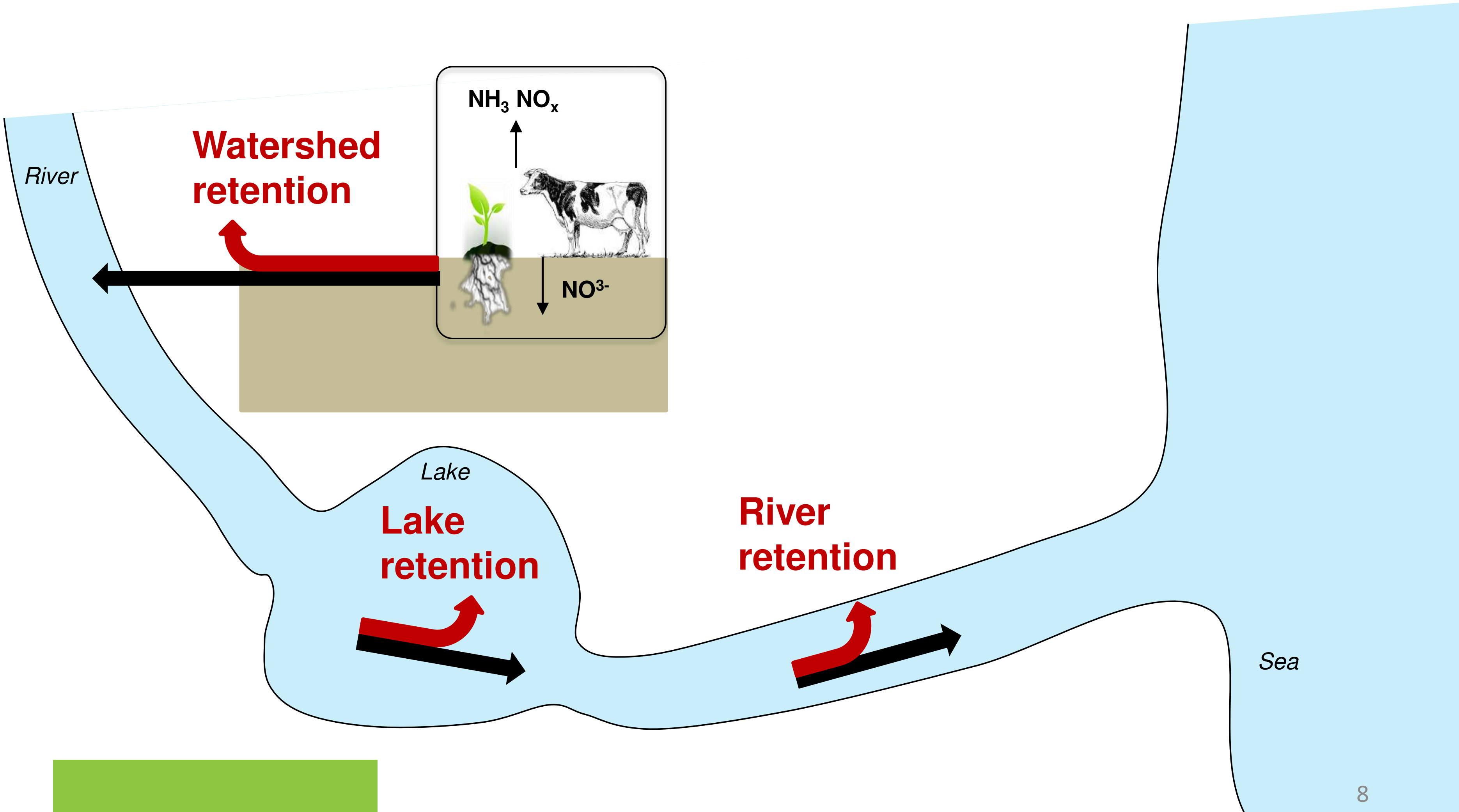
We need a **globally**-valid model

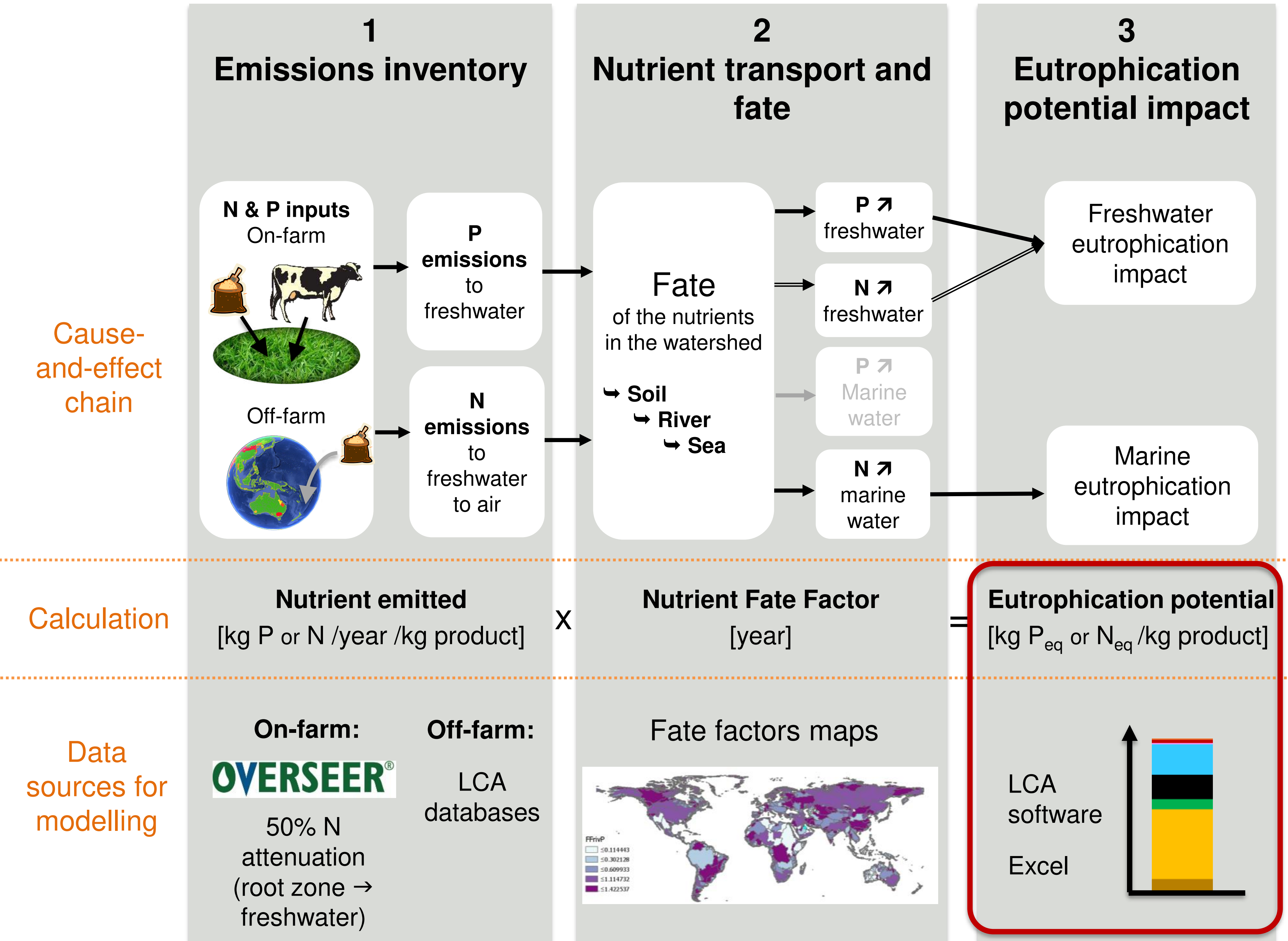
<u>with</u>

site-specific fate factors


1
Emissions inventory
2
Nutrient transport and fate
3
Eutrophication potential impact
Cause-and-effect chain
N & P inputs
On-farm
Off-farm
P emissions to freshwater
N emissions to freshwater to air
Fate
of the nutrients in the watershed
↪ Soil
↪ River
↪ Sea
P ↗ freshwater
N ↗ freshwater
P ↗ Marine water
N ↗ marine water
Freshwater eutrophication impact
Marine eutrophication impact
Calculation
Nutrient emitted
[kg P or N /year /kg product]
X
Nutrient Fate Factor
[year]
=
Eutrophication potential
[kg P_{eq} or N_{eq} /kg product]
Data sources for modelling
On-farm:
OVERSEER®
50% N attenuation (root zone → freshwater)
Off-farm:
LCA databases
Fate factors maps
LCA software
Excel

We derived fate factors for DIN and DIP, accounting for removal processes in soil, rivers and lakes

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Freshwater eutrophication impact
Marine eutrophication impact
Calculation
Nutrient emitted
[kg P or N /year /kg product]
X
Nutrient Fate Factor
[year]
=
Eutrophication potential
[kg P_eq or N_eq /kg product]
Data sources for modelling
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OVERSEER®
50% N attenuation (root zone → freshwater)
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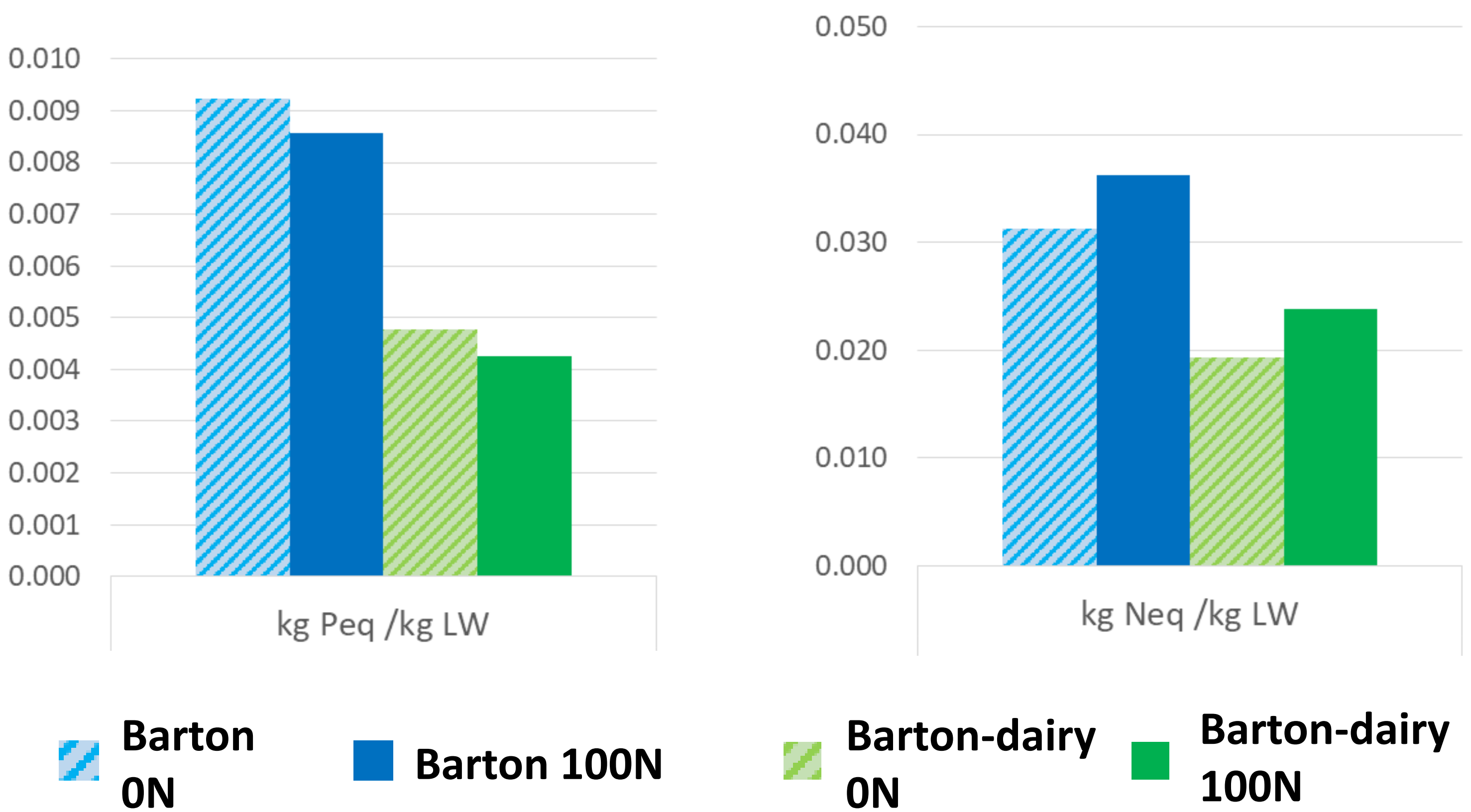
FFrivP
≤0.114443
≤0.302128
≤0.609933
≤1.114732
≤1.422537
LCA software
Excel

Freshwater eutrophication impact from different beef production scenario

Important to consider **N and P**: ranking is different depending on the nutrient considered



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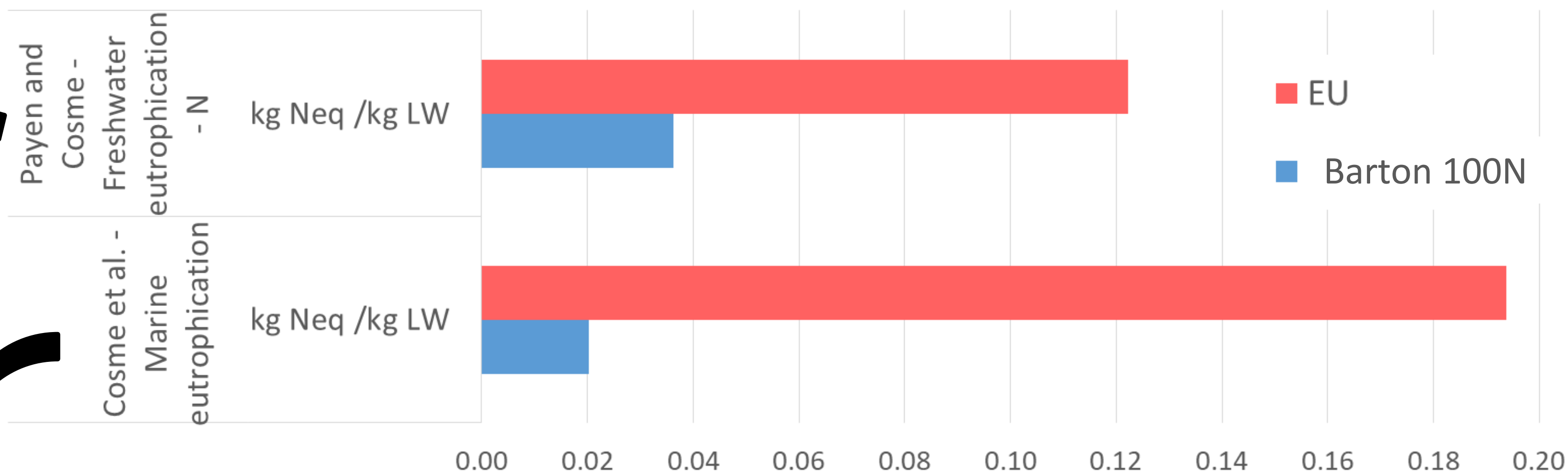
Comparison with average European beef

NZ beef has lower **freshwater and marine** eutrophication impacts

New freshwater indicator accounting for N (to fill the gap identified by UNEP)



Marine eutrophication indicator recommended by UNEP

Can the consumer willingness-to-pay offset the cost to farmers for the reduction of N emissions?

Yes

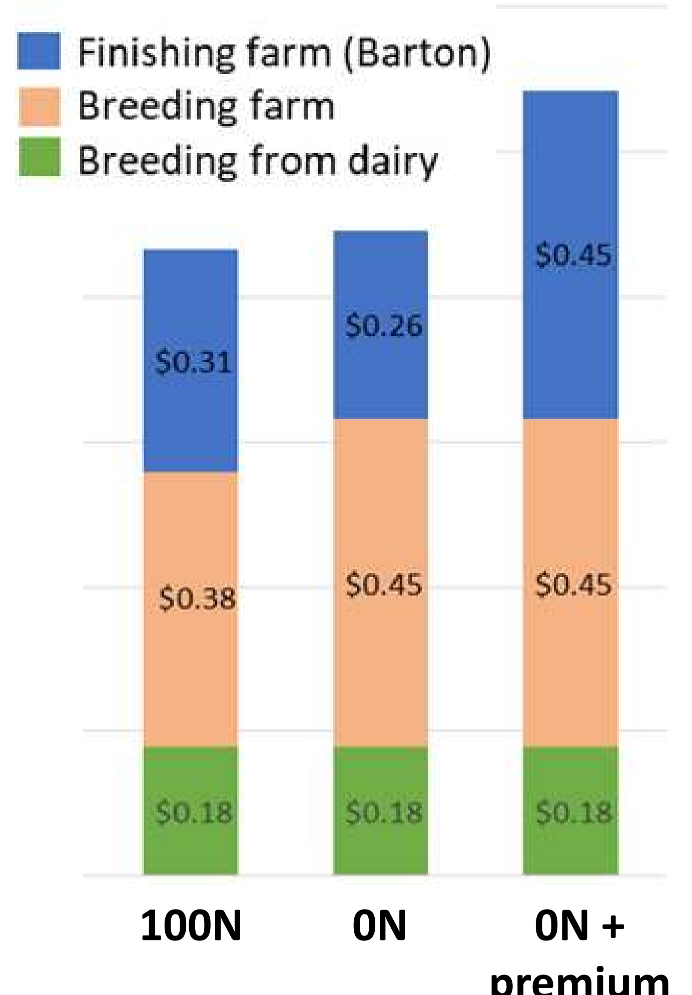
1. Meta-Analysis:

Willingness-to-pay by European consumers for beef with an environmental premium :

32% potential price premium

2. Economic Analysis:

Farm profit estimate (FARMAX) for Taupo Beef case study supply chain to Europe



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Conclusions

To address impacts on freshwater eutrophication, it is paramount that both N and P are accounted for

The current recommendation from the EC for Product Environmental Footprinting has limited relevance to NZ and is very likely to change to follow the UNEP/SETAC guidelines (to be released officially in March 2019)

A new indicator for freshwater eutrophication was developed which aligns with UNEP/SETAC guidelines:

- ► to account for the contribution of N (was missing),
- ► in a spatially-explicit way (accounting for catchment characteristics),
- ► with a global coverage (essential since our supply chains are global).

Evaluation of Taupo Beef on the European market with average European beef showed lower freshwater and marine eutrophication impacts for NZ beef

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Thank you
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