Assessment of Eutrophication impacts in Water Footprinting

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Water Footprinting Workshop - Wellington - 11th November 2016

Outline

- Water footprint profile includes eutrophication
- Eutrophication indicators applied in NZ
- Methodological issues for NZ… and beyond

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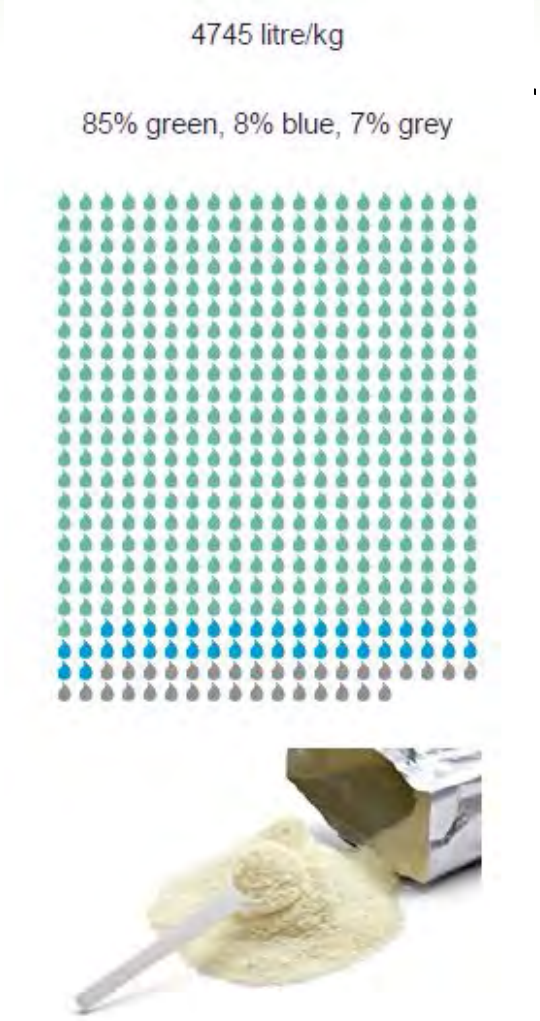
💣 Water Footprintsss: Volumetric vs. Impacts



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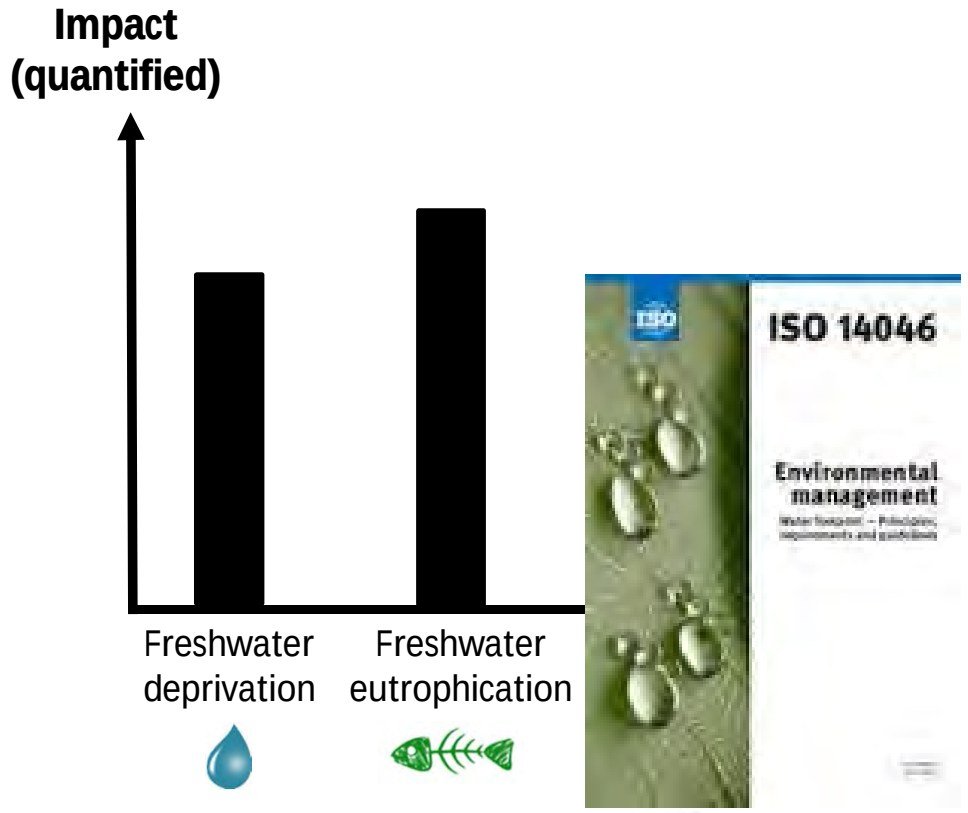

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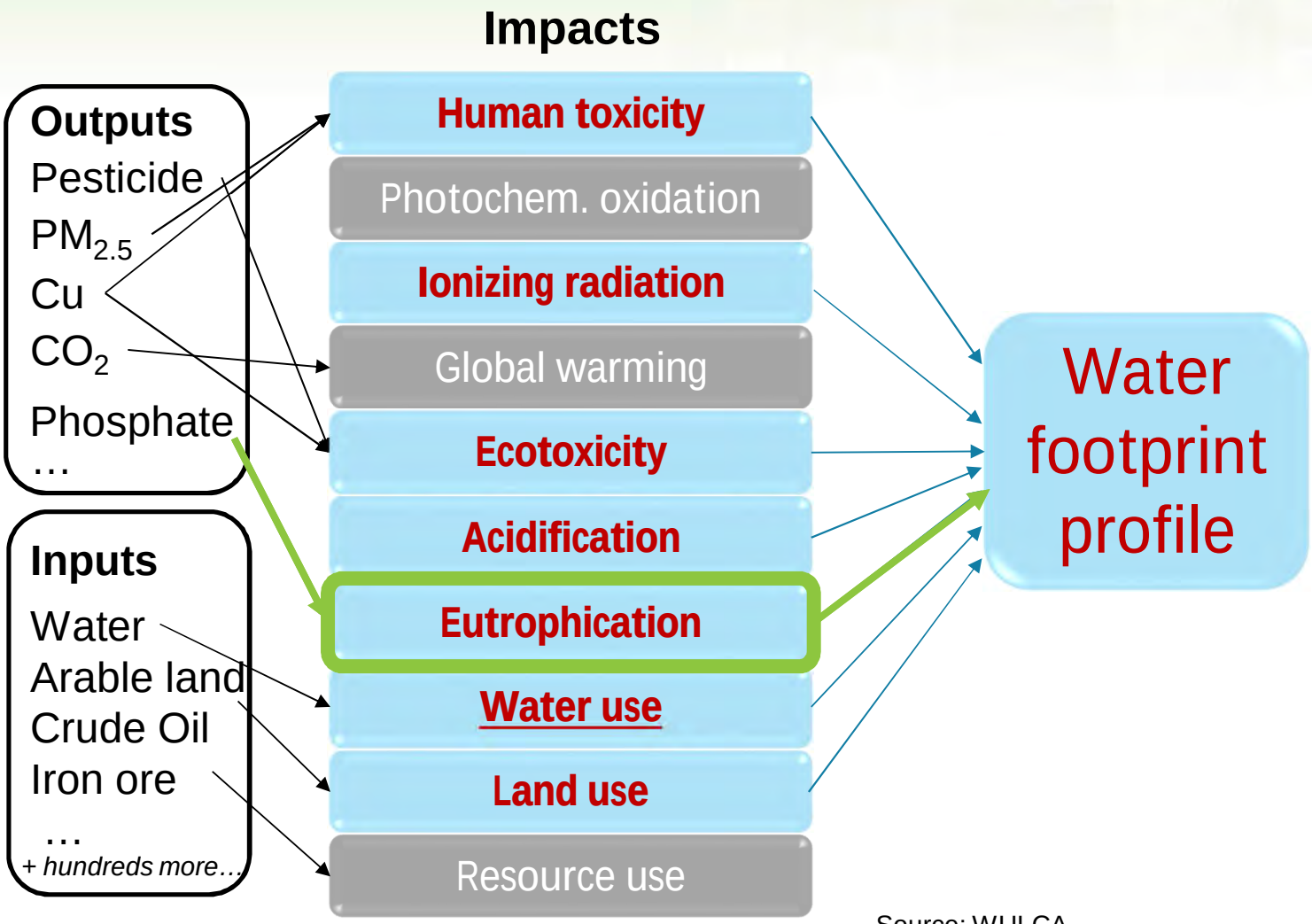
The water footprint profile



Source: WULCA

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Objective

Relevance of LCIA methods
to estimate freshwater eutrophication impacts
of NZ milk and meat ?

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Eutrophication in a nutshell

"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)

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Case study - Lake Taupo

Lake Taupo catchment

Average **dairy** and **sheep & beef** farms

Assessing freshwater eutrophication impacts in LCA:

Which options?

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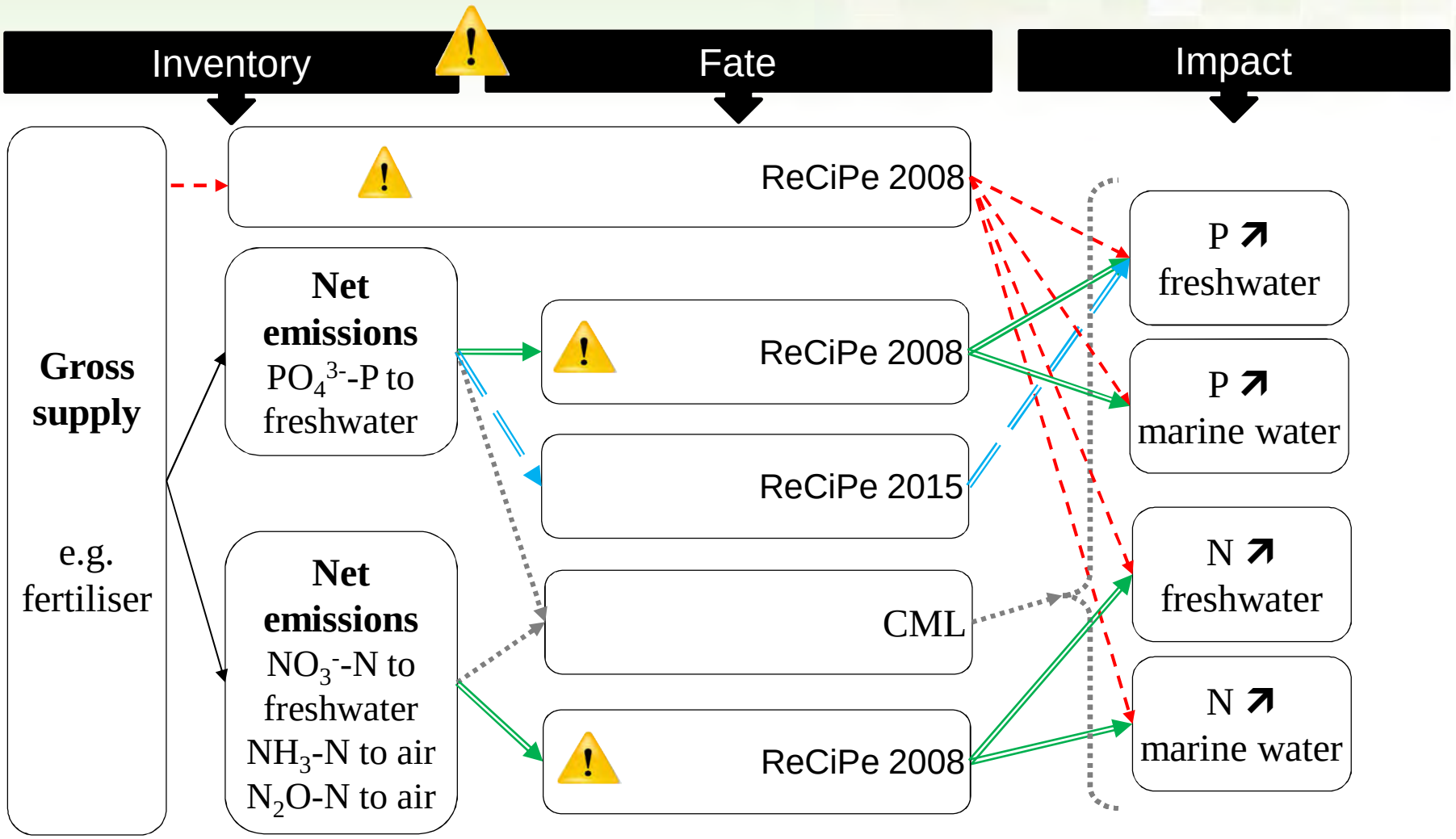
Different methods available



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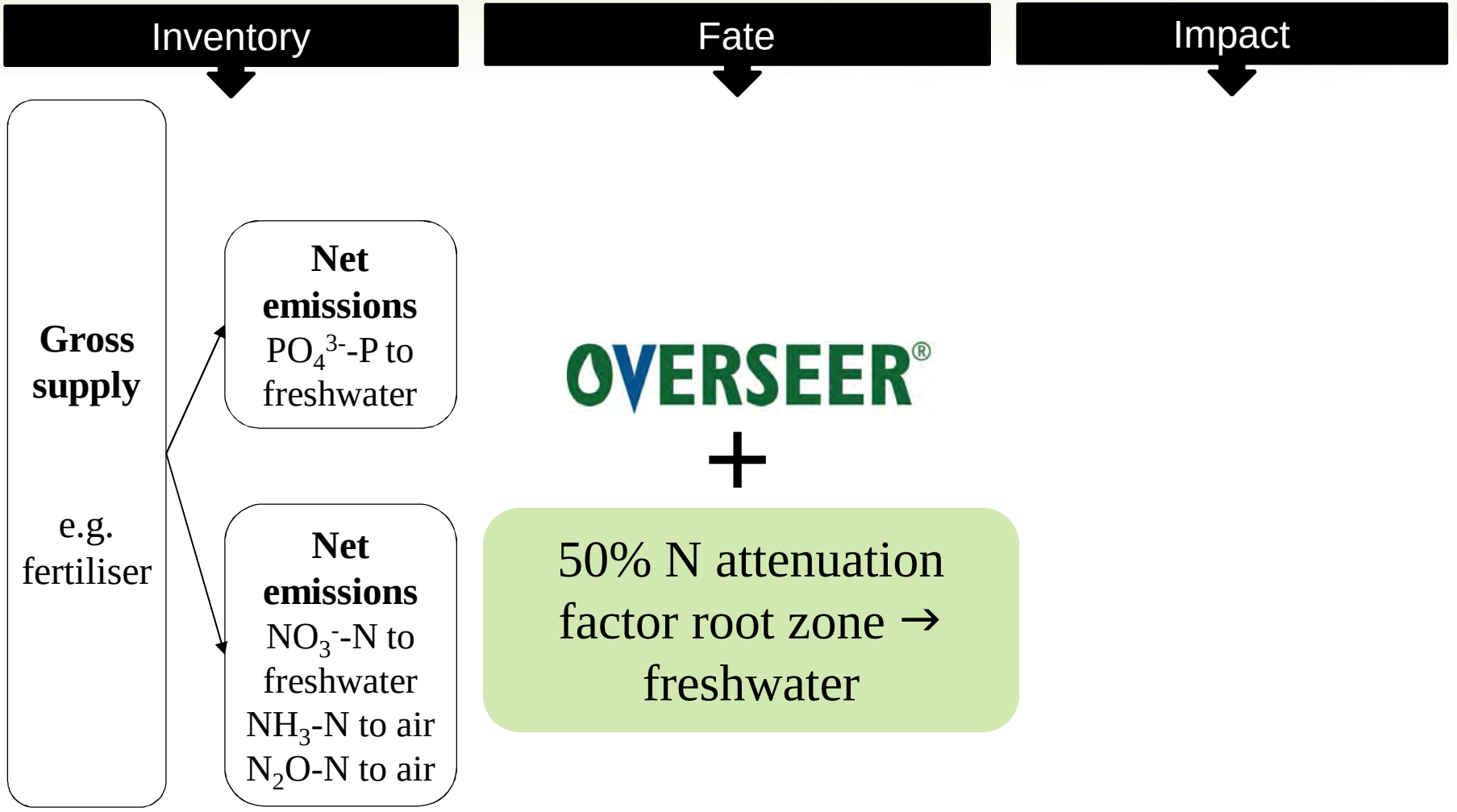
Site-specific nutrient emissions modelling



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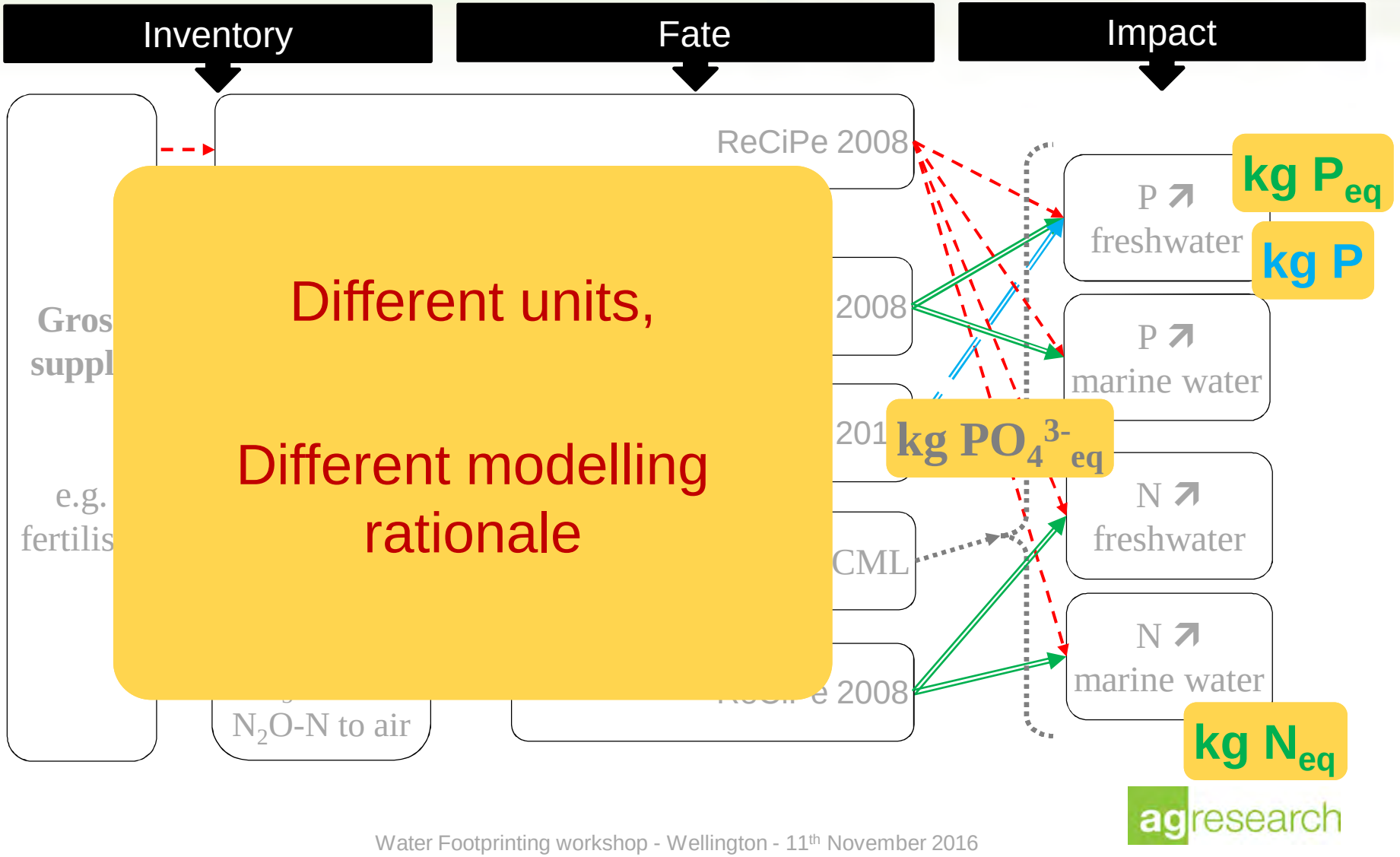
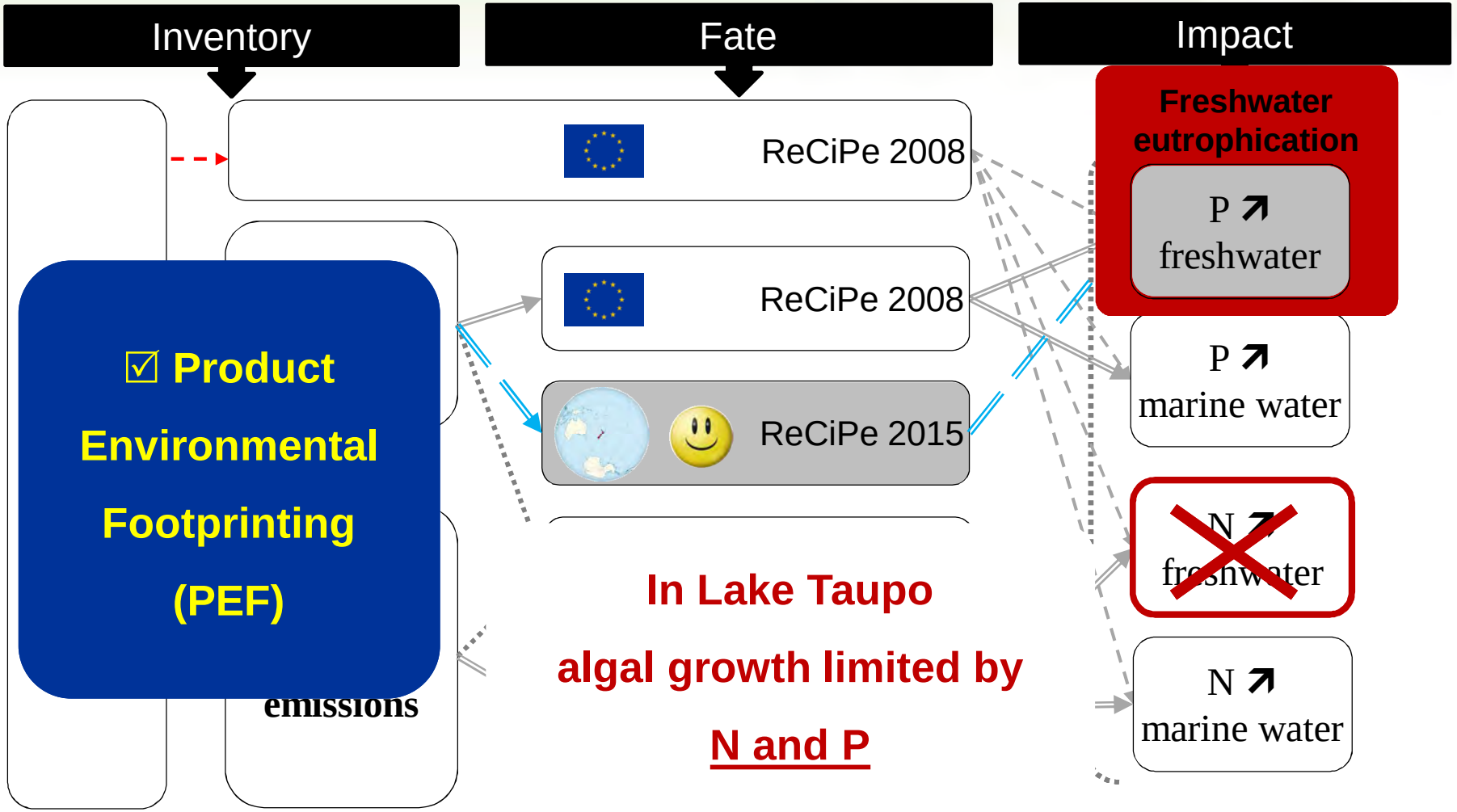
Impacts: an impossible comparison



Geographical validity - Regionalisation



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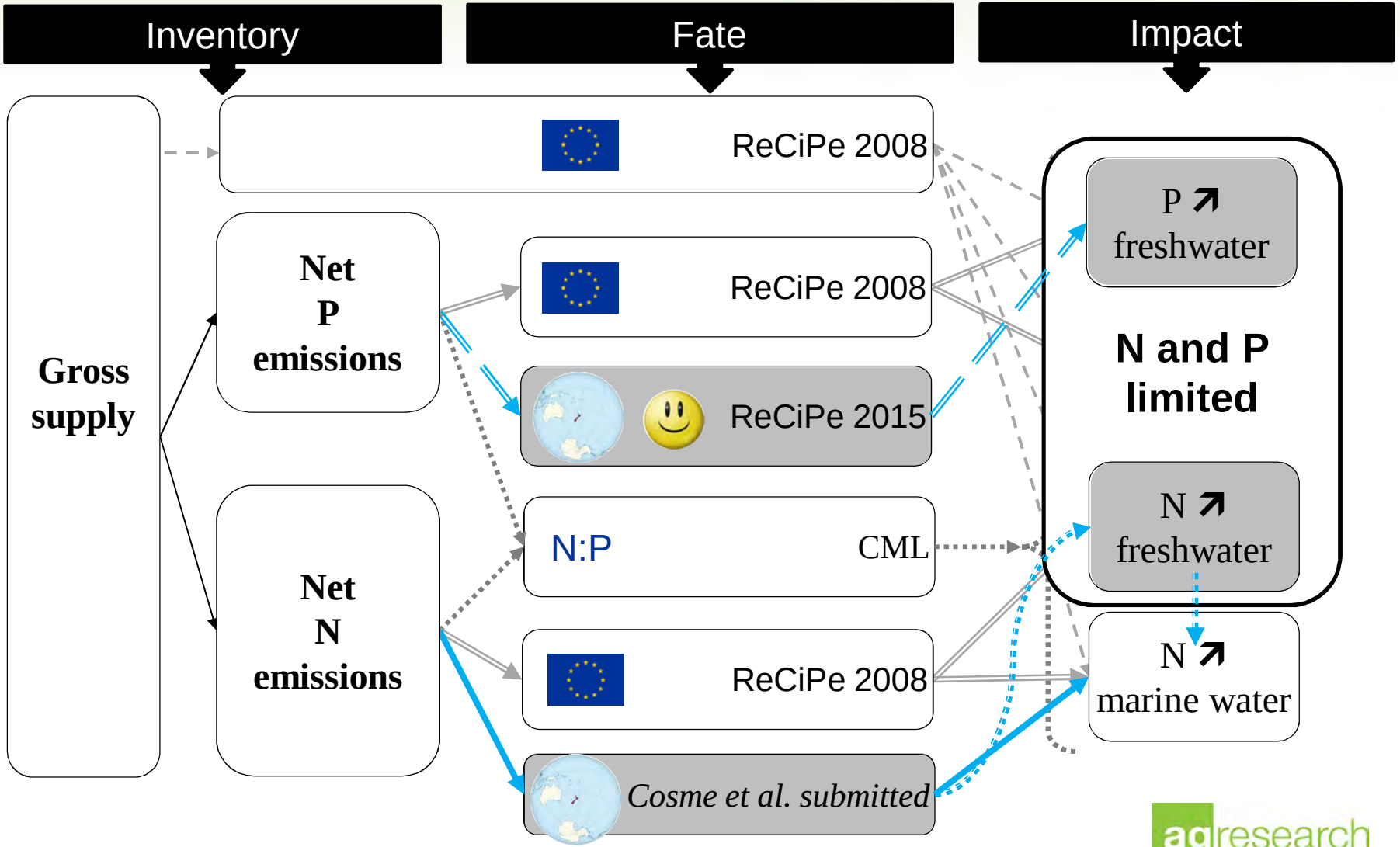

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Water body sensitivity

Accounting for freshwater body sensitivity is paramount

Current assumption:

P-limited freshwaters only

N-limited marine water only

BUT

Freshwater impact model focused on P is:

- ✓ only **capturing part of the problem**
- ✓ **in contrast to water regulations** in NZ

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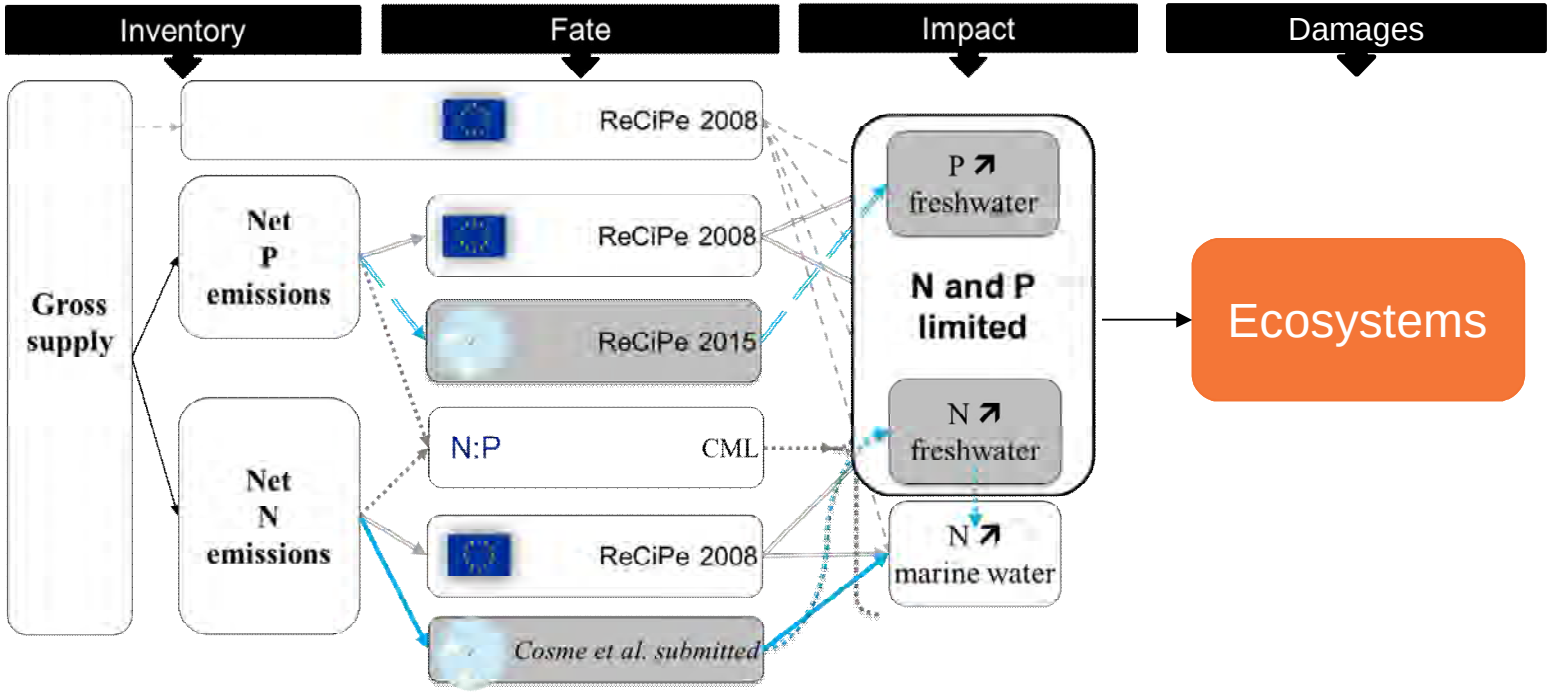
Eutrophication effect modelling in LCA



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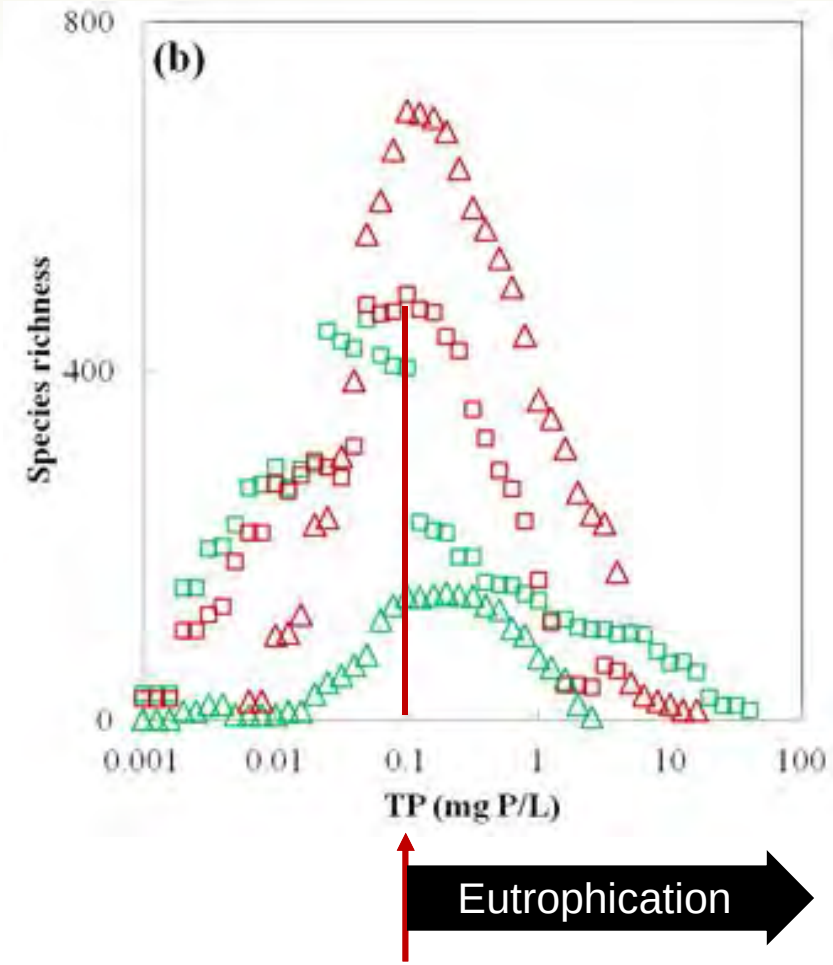
Eutrophication effect modelling in LCA

Azevedo et al. 2013



TP optimum

For heterotrophs in lakes

Species richness – TP relationships used to identify $TP_{optimum}$

Effect starts at

$TP > TP_{optimum}$

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Effect modelling - outside domain of validity

Azevedo et al. 2013

TP optimum

P = 0.0052 mg.L^{-1} **< 0.1 mg.L^{-1}**

N regulations !

P < 0.0056 mg.L^{-1} Target P < 0.15 mg.L^{-1}

LCA fails to account for a high standard of water quality that is in a near-pristine state

➡ Review the definition of “Eutrophication”?

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Conclusions

Lake Taupo is an illustration, this is valid beyond NZ:

► Freshwater eutrophication is determined by both N and P

► Low “background” concentration of nutrient

► High standard of water quality

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PEF recommendation not appropriate for NZ (and beyond): **Europe** & **P** only

We need **globally** valid model, but **site-specific** characterization factors:

- P fate modelling: Helmes et al. (2012)
- N fate modelling: Cosme et al. (2016)

→ Combine the two for co-limited freshwaters?

…meanwhile: should we use CML in NZ??

Review the definition of "Eutrophication" for effect modelling?

Thank you for your attention

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