

Ecosystem services as a tool to evaluate restoration of Lake Rotorua

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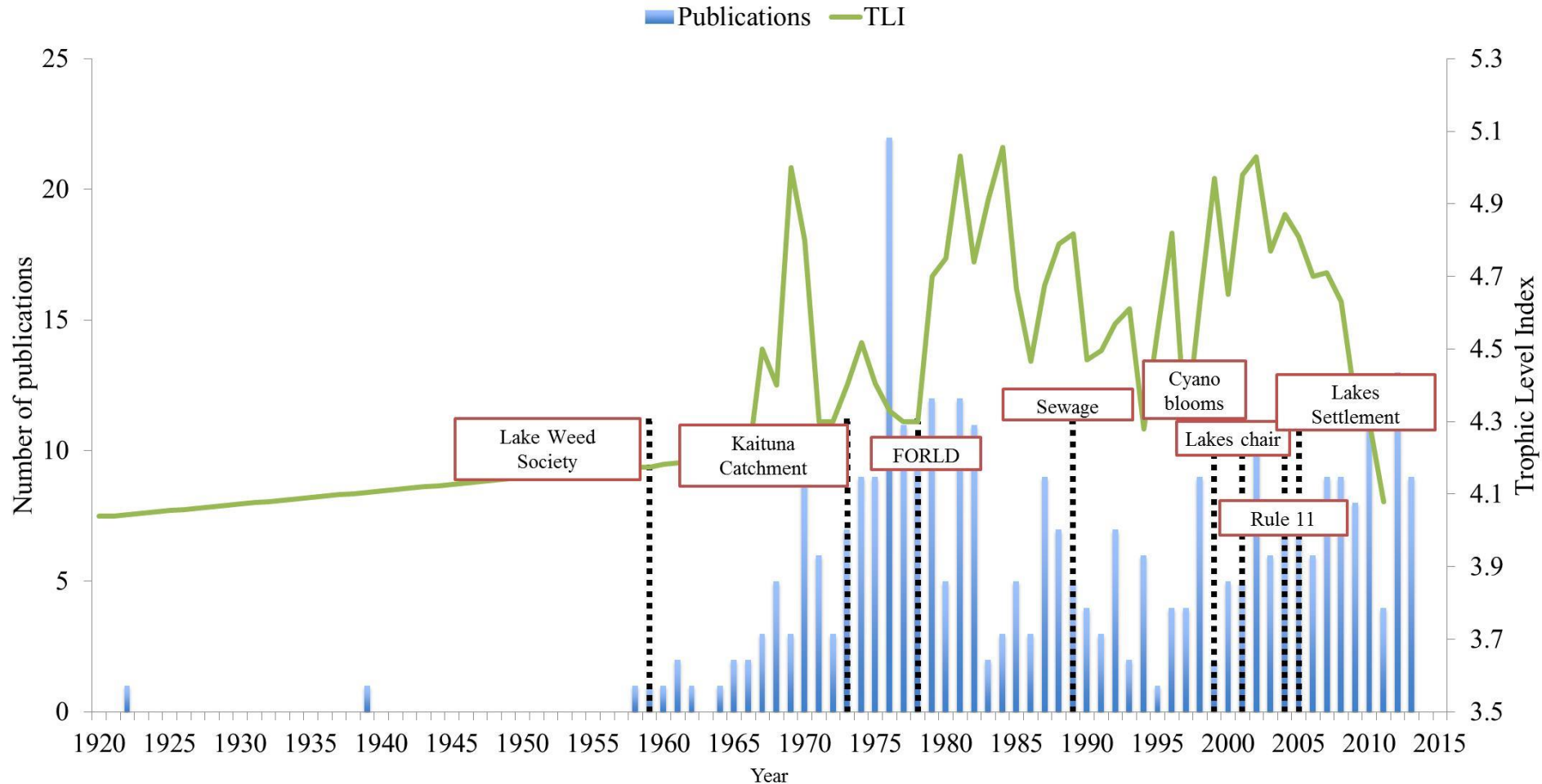
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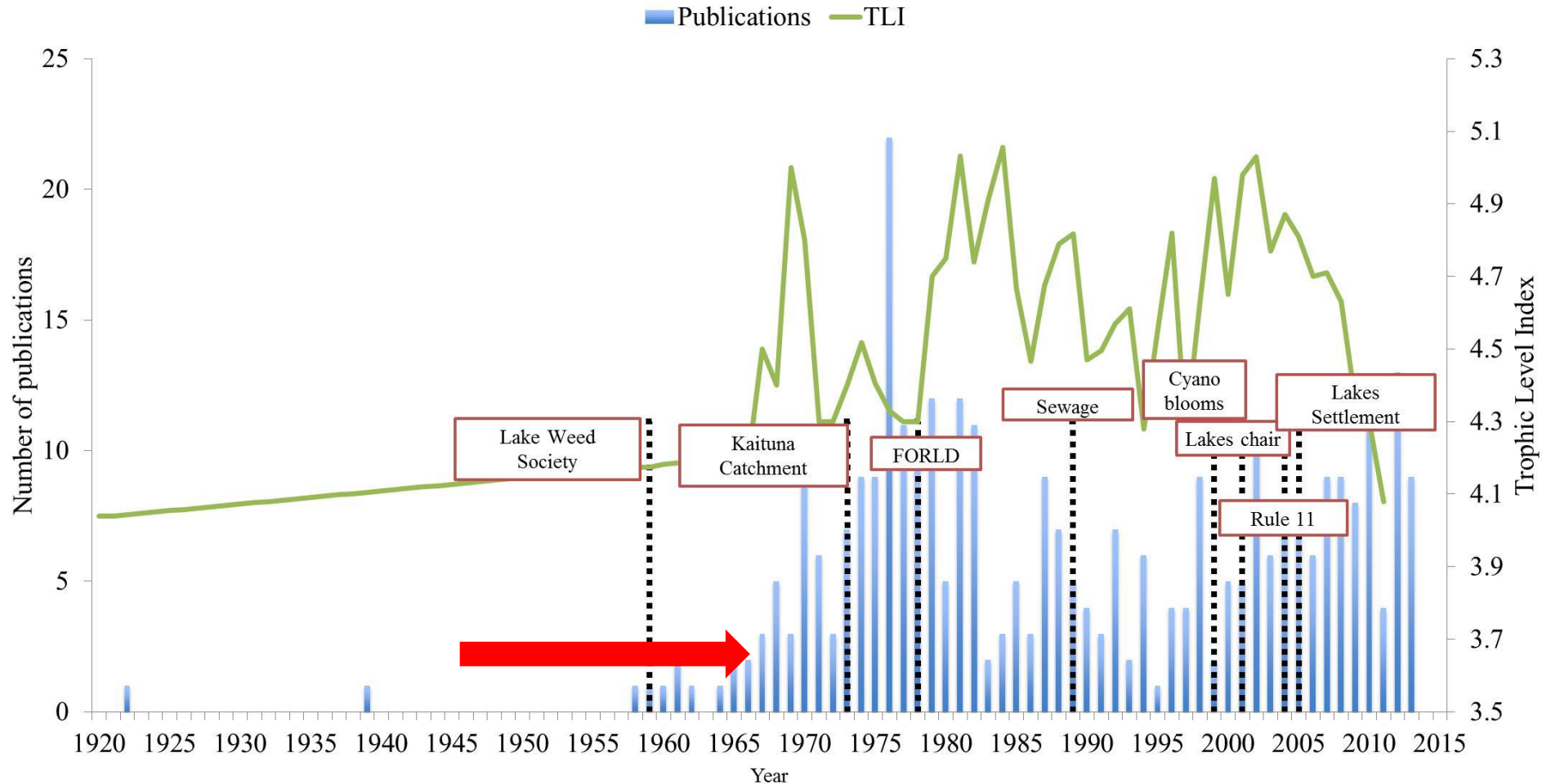
Restoration efforts of Lake Rotorua

- Drivers of eutrophication (nutrient enrichment)
 - point sources, diffuse nutrient sources
- Management responses
 - in-lake and land management

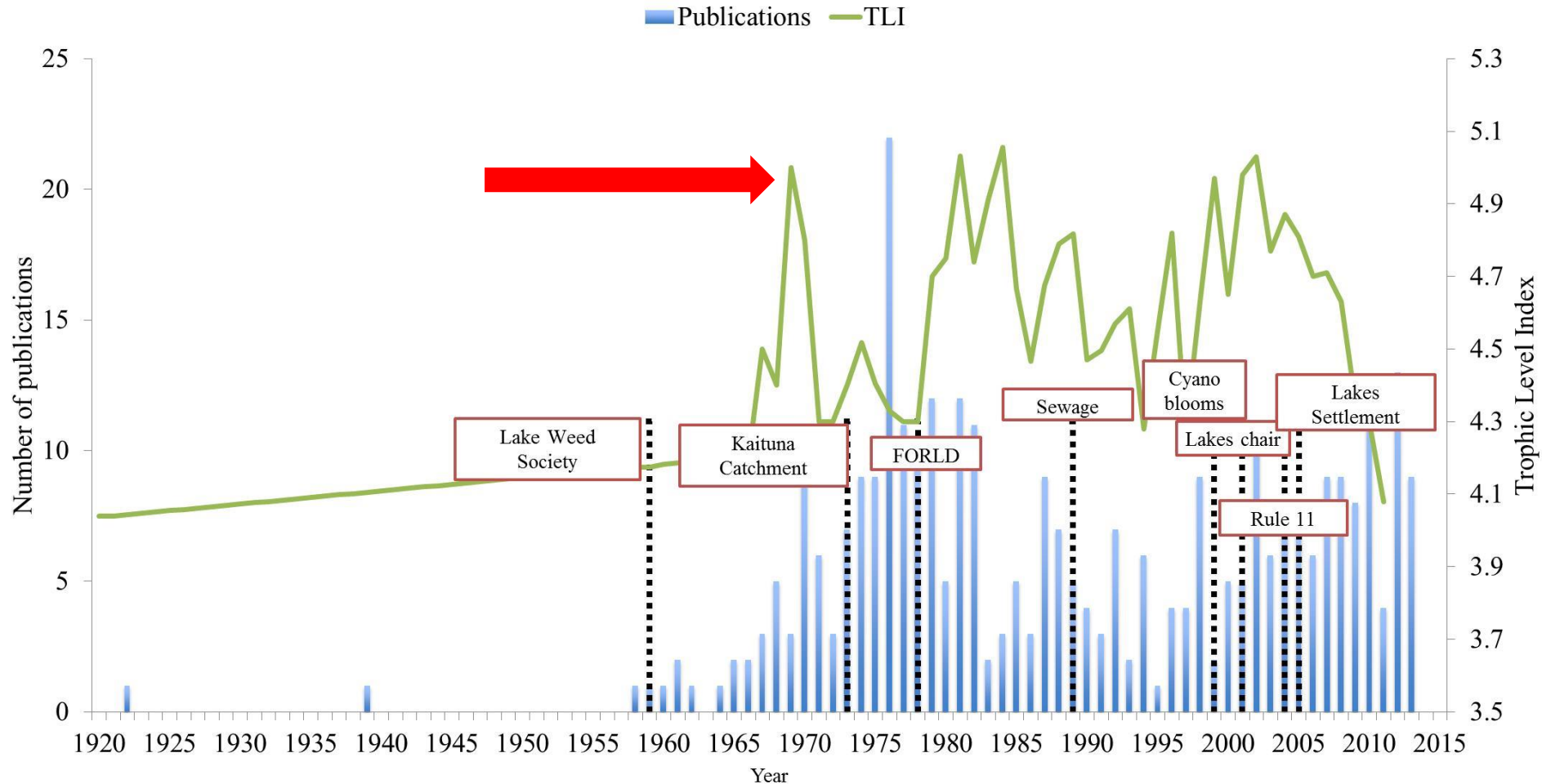
Restoration lags



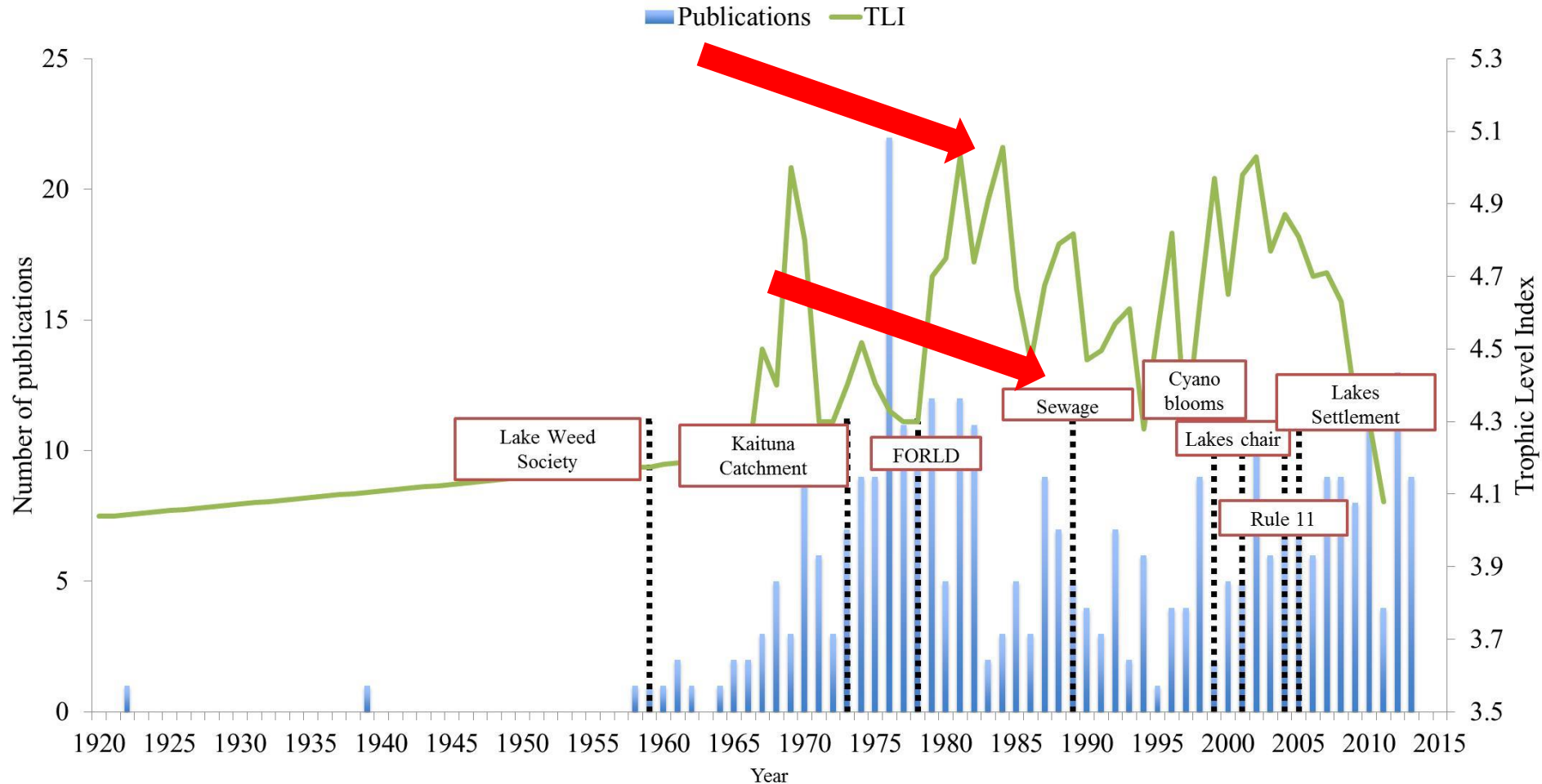
Restoration lags



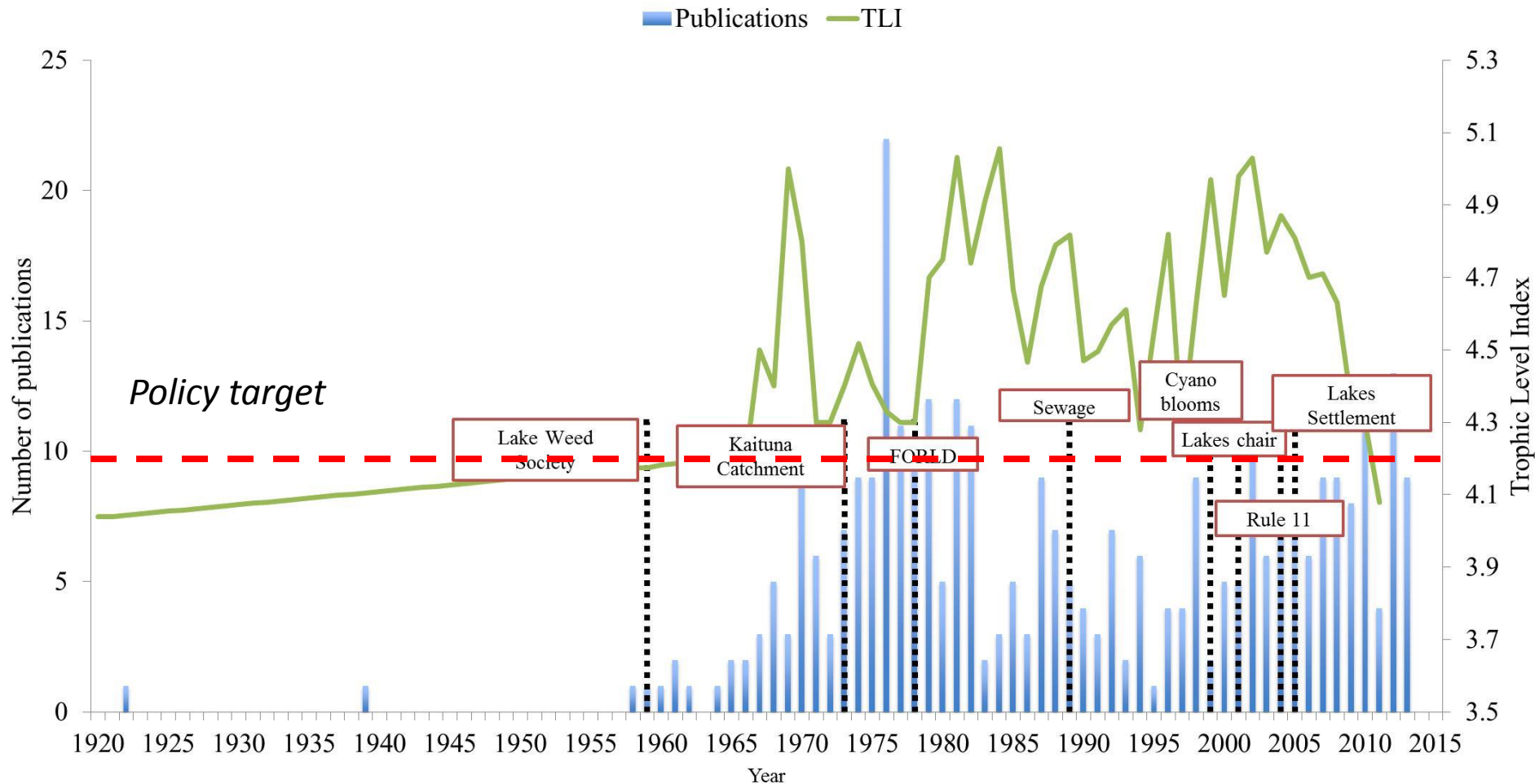
Restoration lags



Restoration lags



Restoration lags

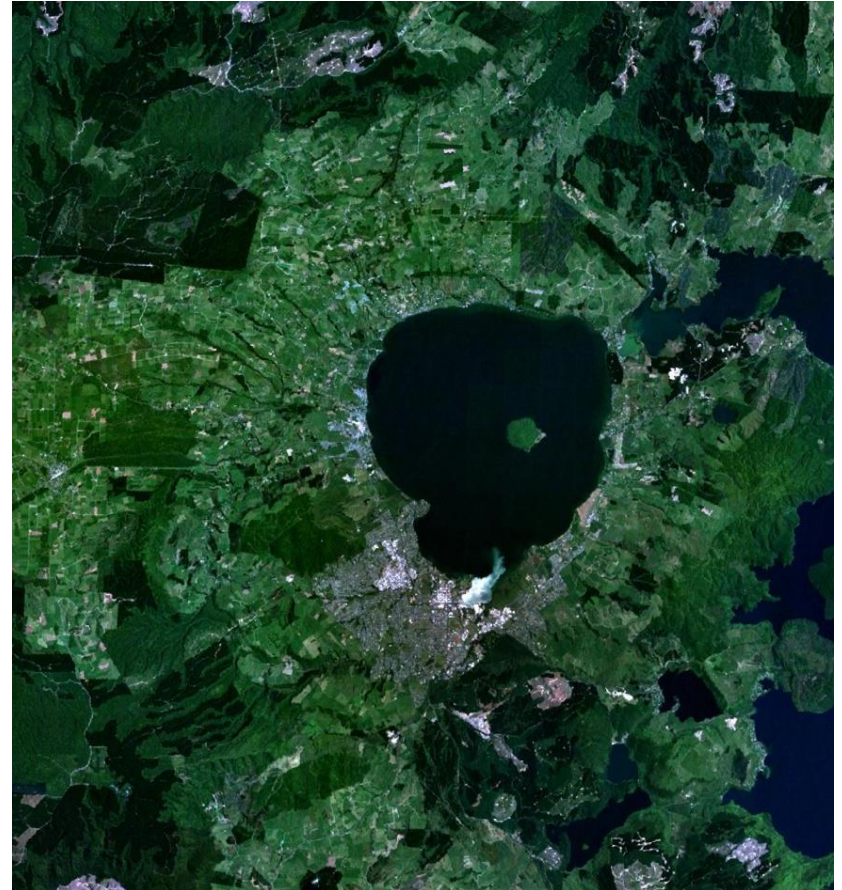


<https://www.lernz.co.nz/tools-and-resources/fact-sheets>

Mueller et al. 2015 Environ. Res. Lett

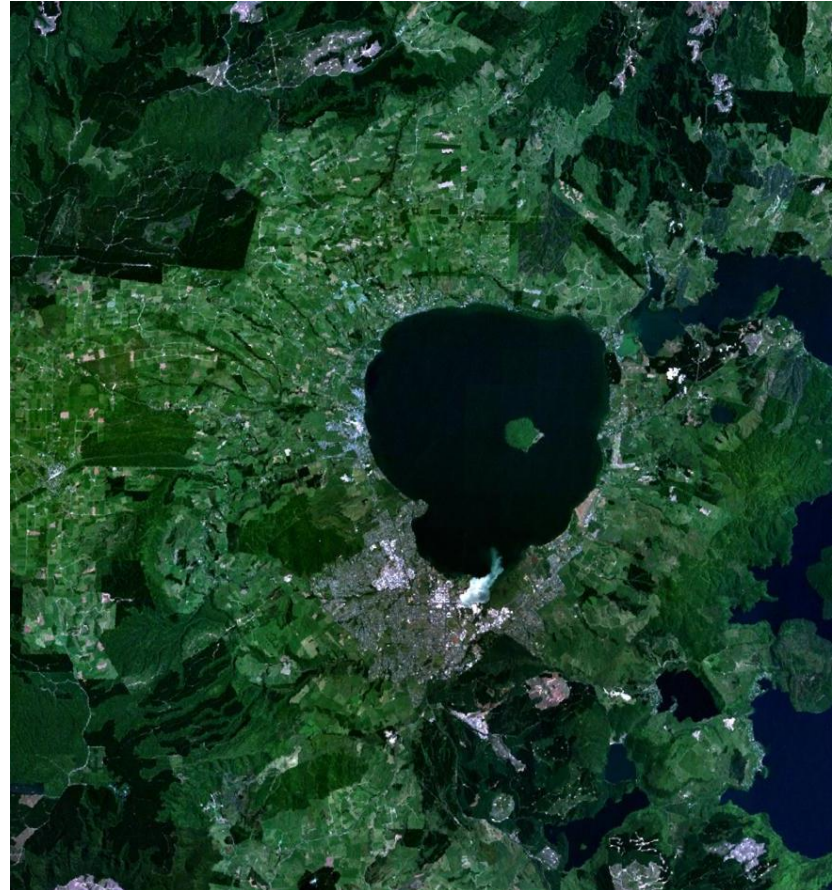
Ecosystem services of Lake Rotorua

- *What are ecosystem services?*
- *Food*
- *Biodiversity*
- *Nutrient processing*
- *Recreation*
- *Aesthetics*
- *Education*

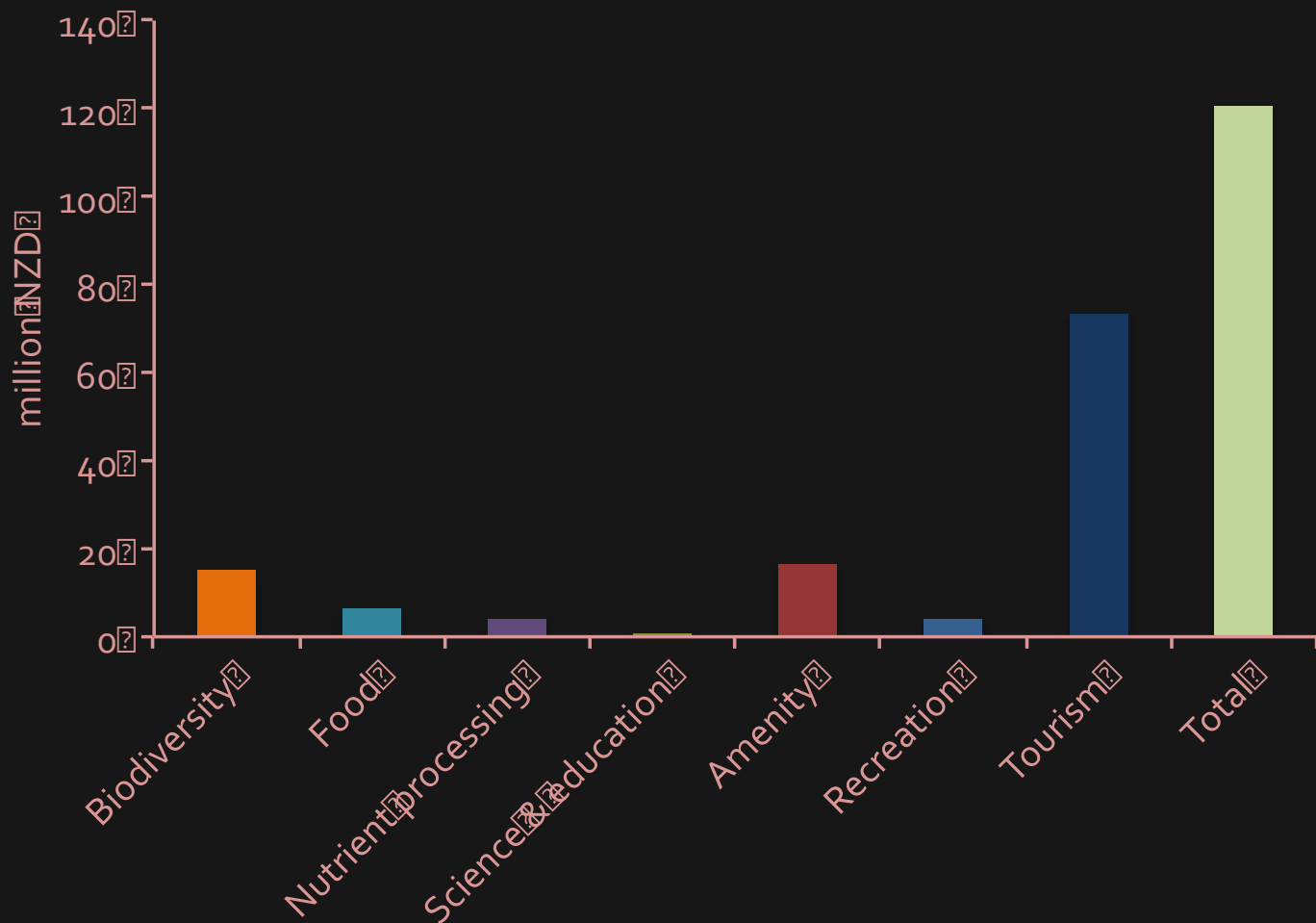


Ecosystem services valuation

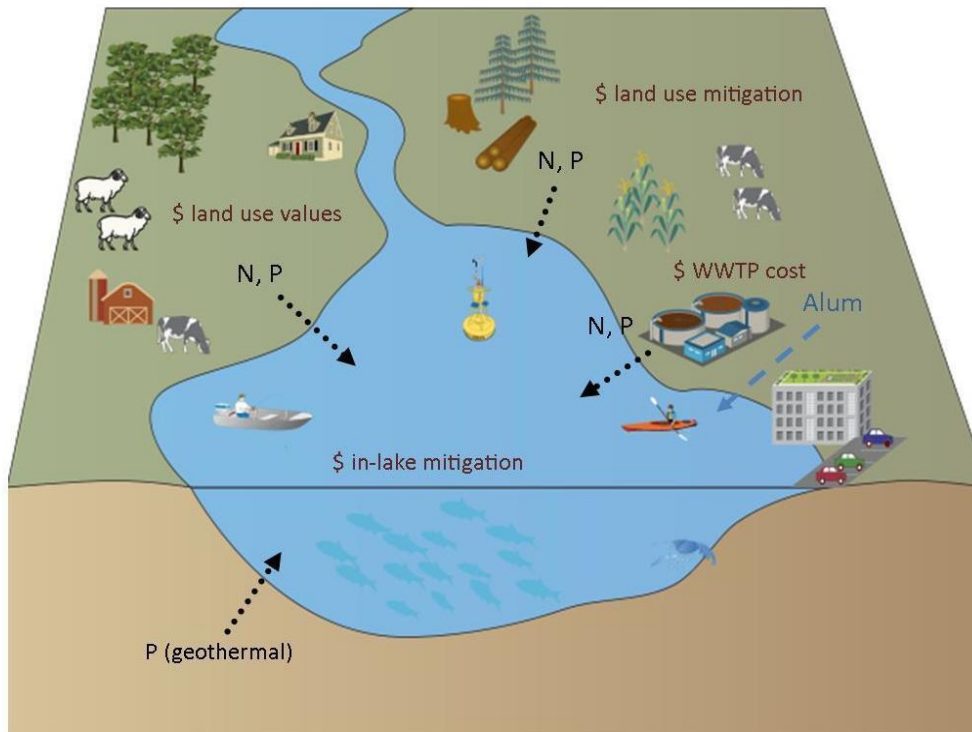
- *Valuation for 2012*
- *TLI 4.1*
- *Values in 2012 NZD*
- *Valuation of each ecosystem service using appropriate method for data available*
- *Indirect and direct pricing, including hedonic pricing and existence value*



Ecosystem services values for Lake Rotorua



Integrated lake and catchment analysis

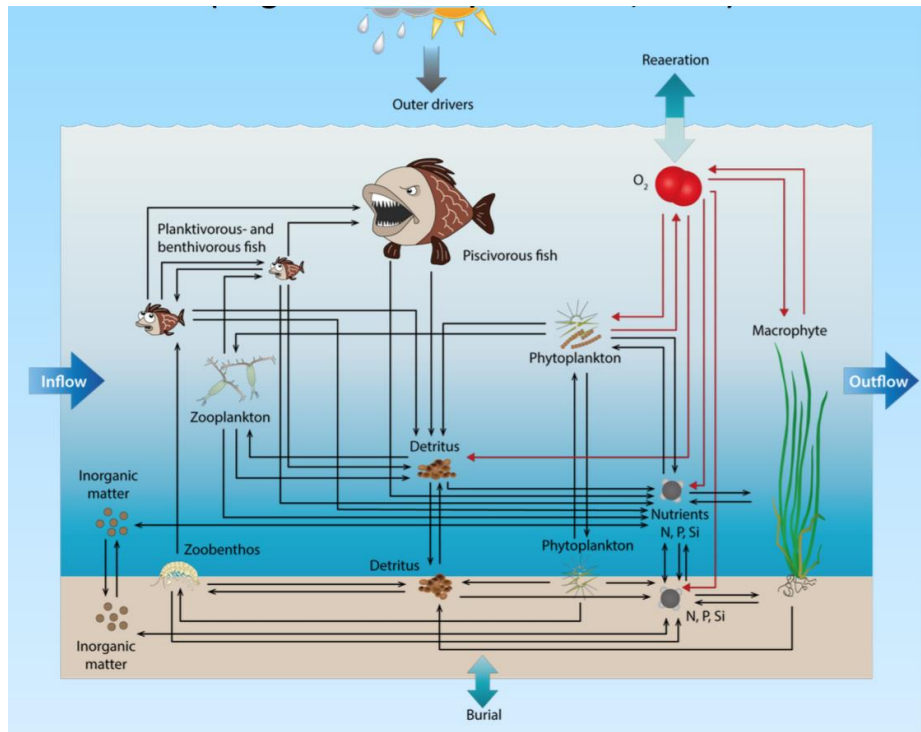


- Cost-benefit analysis of catchment and in-lake mitigation options
- Based on nutrient load scenarios and resulting water quality
- Valuation of land use types using ecosystem services

Lake model

Input

Nutrient loads,
 total nitrogen +
 phosphorus

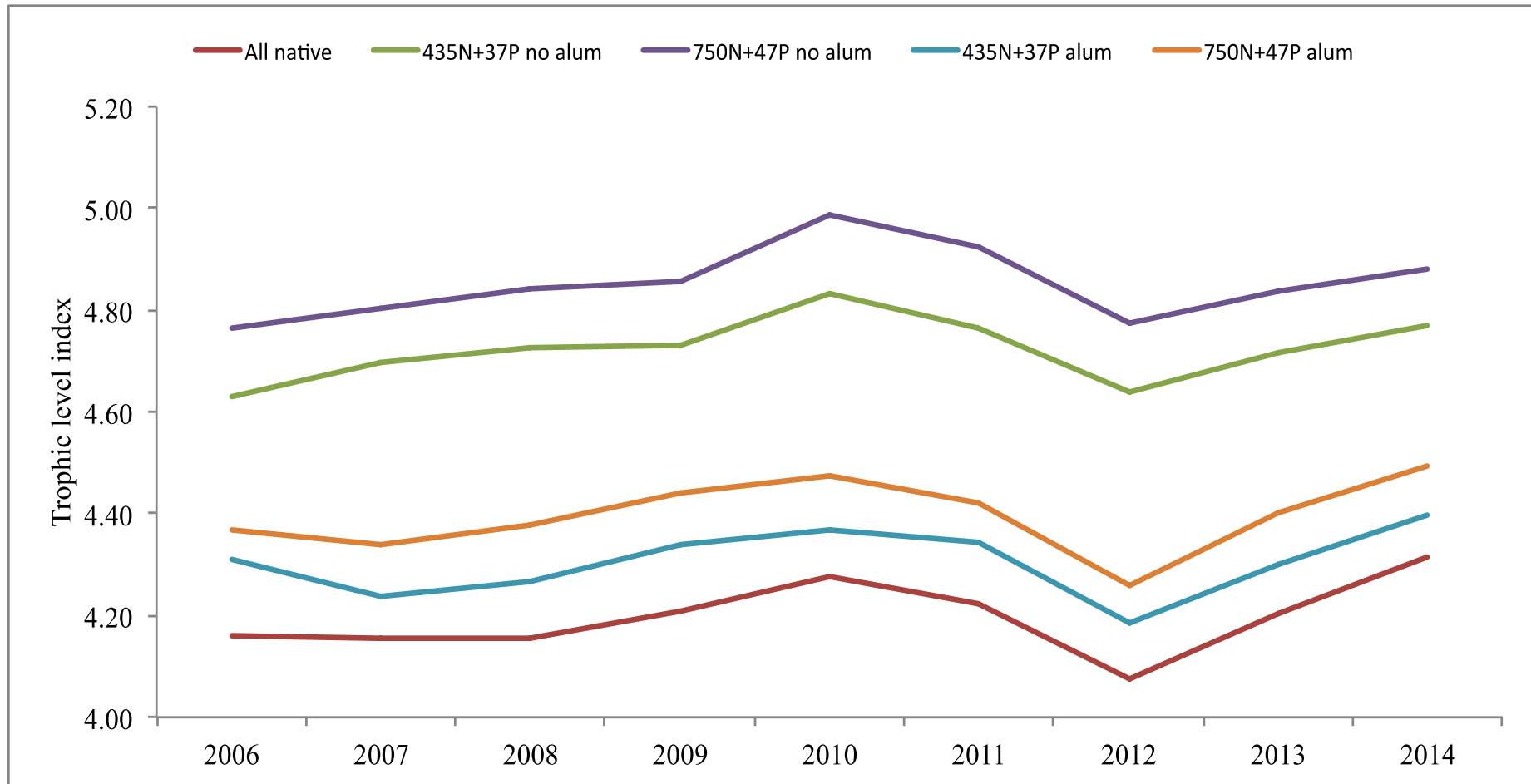


Output

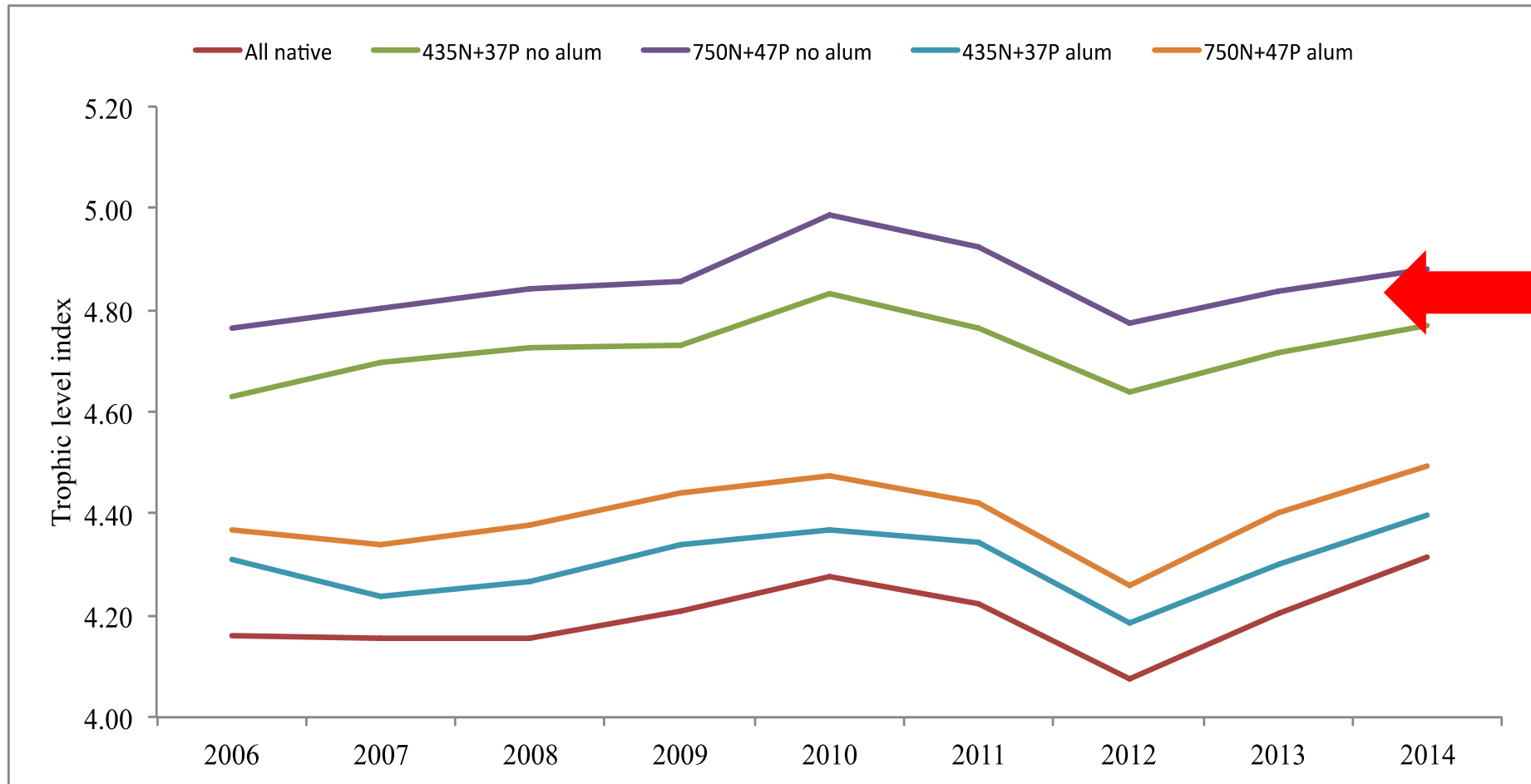
Water quality
 calculate using
 Trophic Level
 Index

DYRESM-CAEDYM coupled hydrological-ecological lake model

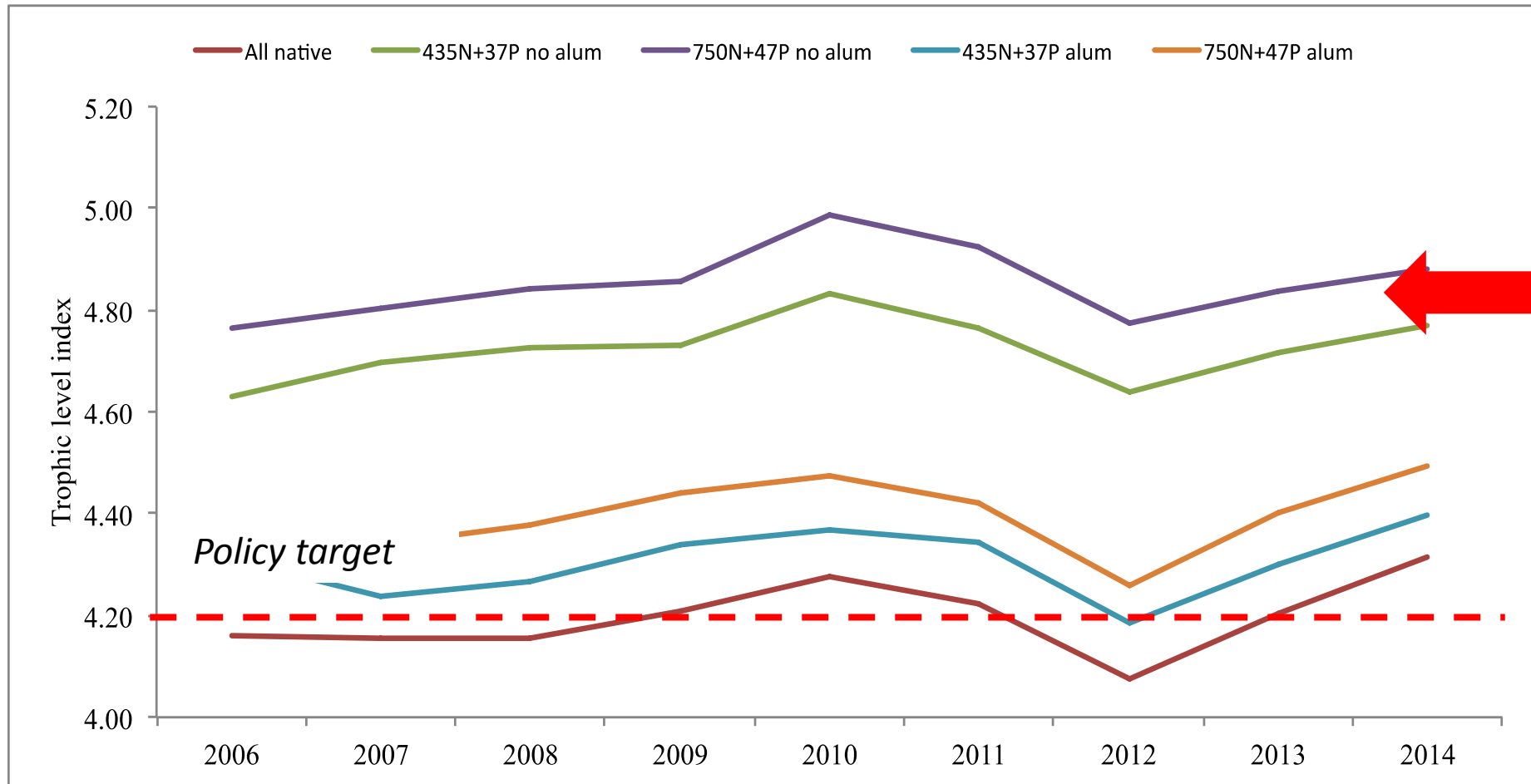
Water quality scenarios



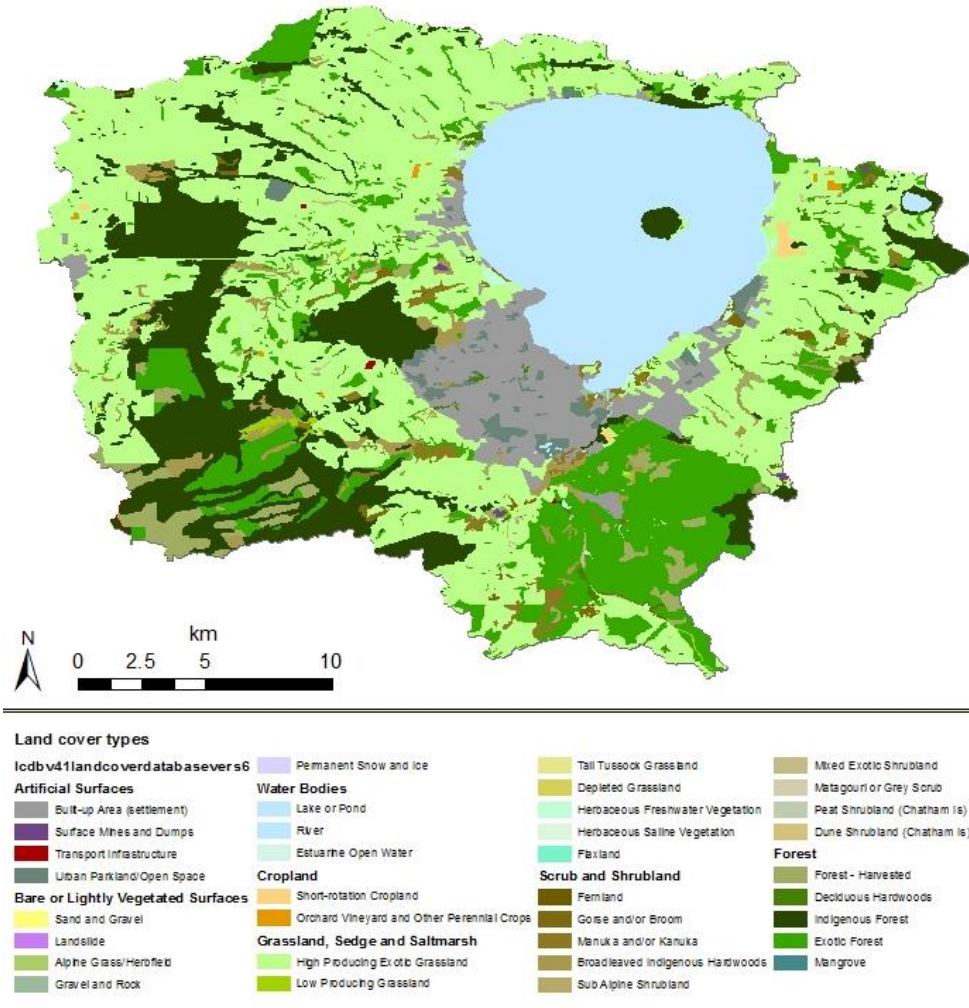
Water quality scenarios



Water quality scenarios

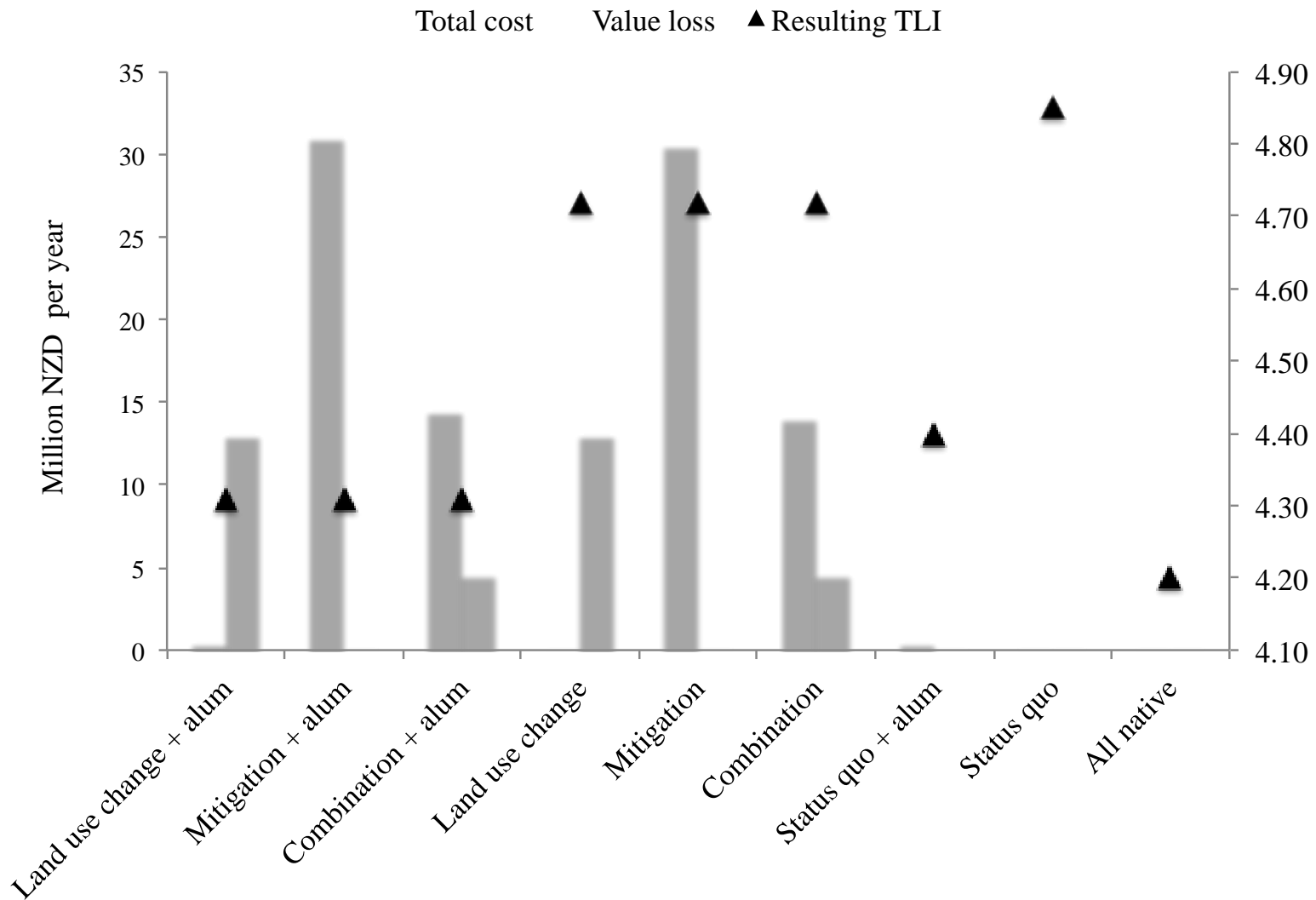


Catchment land use scenarios to reduce nutrient load

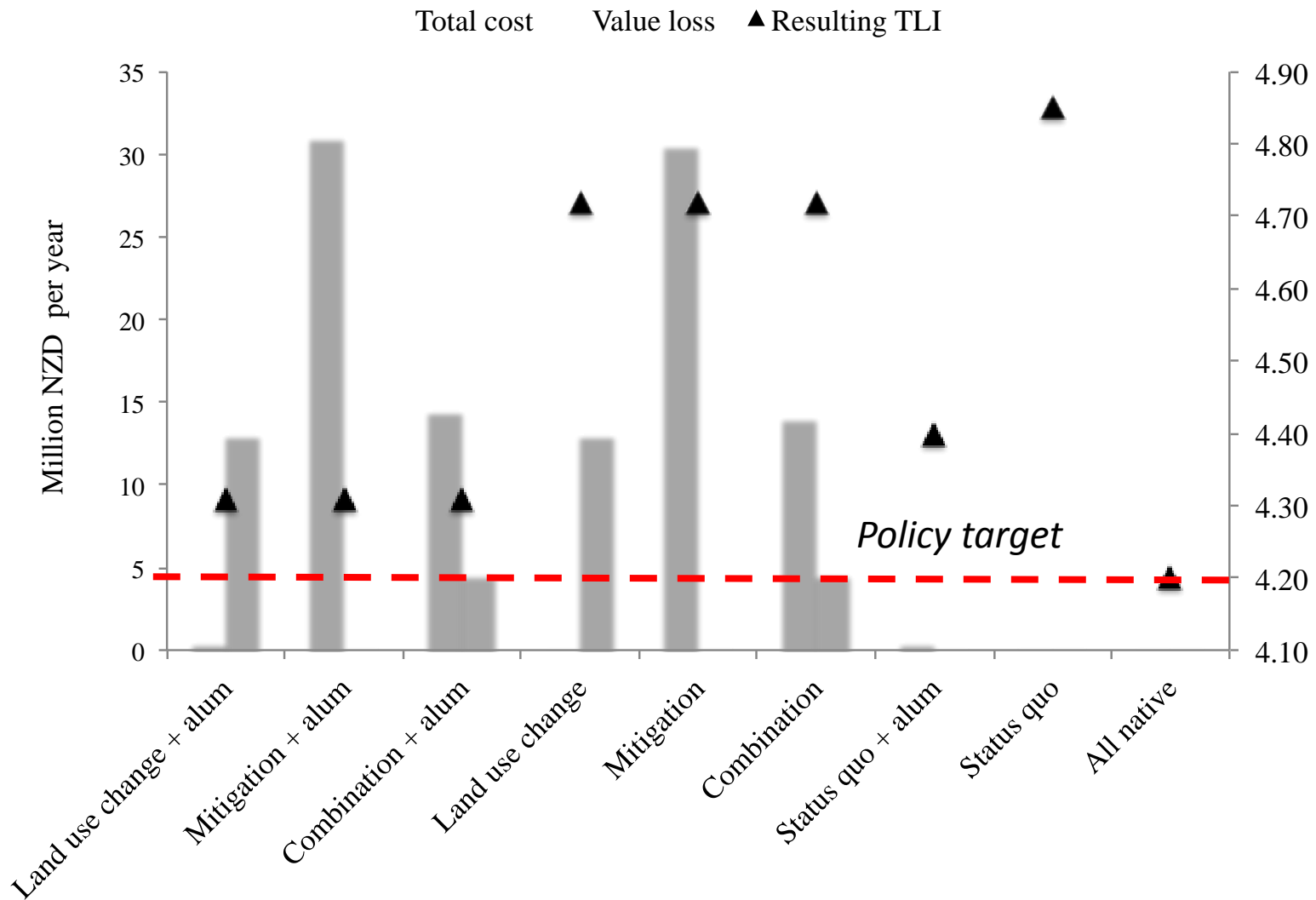


- Land use change
- Mitigation
- Combination
- In-lake mitigation: alum dosing
- Value loss calculated using ecosystem services values and land values for each land use type

Mitigation costs, land value loss and water quality effects



Mitigation costs, land value loss and water quality effects



Major findings

- Currently alum required to meet water quality target (in the short term)
- Combination of in-lake mitigation and land mitigation most effective at improving water quality
- An amount of land use change might be cost-effective, when combined with mitigation

Implications of research

- Better integration of science and policy can lead to reduction in lag times and faster implementation of management changes
- Integrated approach shows economic values of lake and catchment
- Lake Rotorua needs continuous in-lake and land mitigation, and long-term planning towards ongoing restoration and protection of ecosystem health

Acknowledgements

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