Scott Larned
Ton Snelder

NIWA Taihoro Nukurangi | landwaterpeople | LWP | OUR LAND AND WATER | Toitū te Whenua, Toiora te Wai | National SCIENCE Challenges

Land use effects on aquatic ecosystems: improving the evidence base

Evidence, everywhere

The Roadmap sets out the science questions that will need to be answered to provide the evidence base to inform environmental and conservation policy.

- The Conservation and Environment Science Roadmap

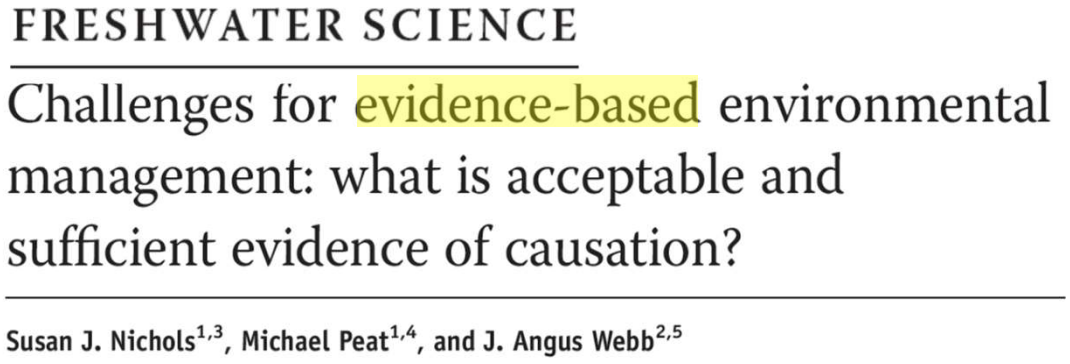
We need to put science to the fore and have evidence-based arguments to make ourselves credible.

- William Rolleston, Federated Farmers

Enhancing evidence-informed policy-making. Report to the Prime Minister

Will the road to 2030 be evidence-paved? Report on the United Nations Sustainable Development Goals

- Sir Peter Gluckman, PMSCA



What do people actually want when they call for evidence of land-use effects?

- Evidence that some land-use practices have adverse effects (or evidence to the contrary).
- Evidence that other land-use practices (including mitigation measures) have beneficial effects.
- Evidence that the environmental benefits of changing land-use practices justify the costs.
- Evidence that regulations (e.g., consent conditions, water conservation orders) have beneficial effects.

Strong cause-and-effect relationships

Why is strong evidence needed?

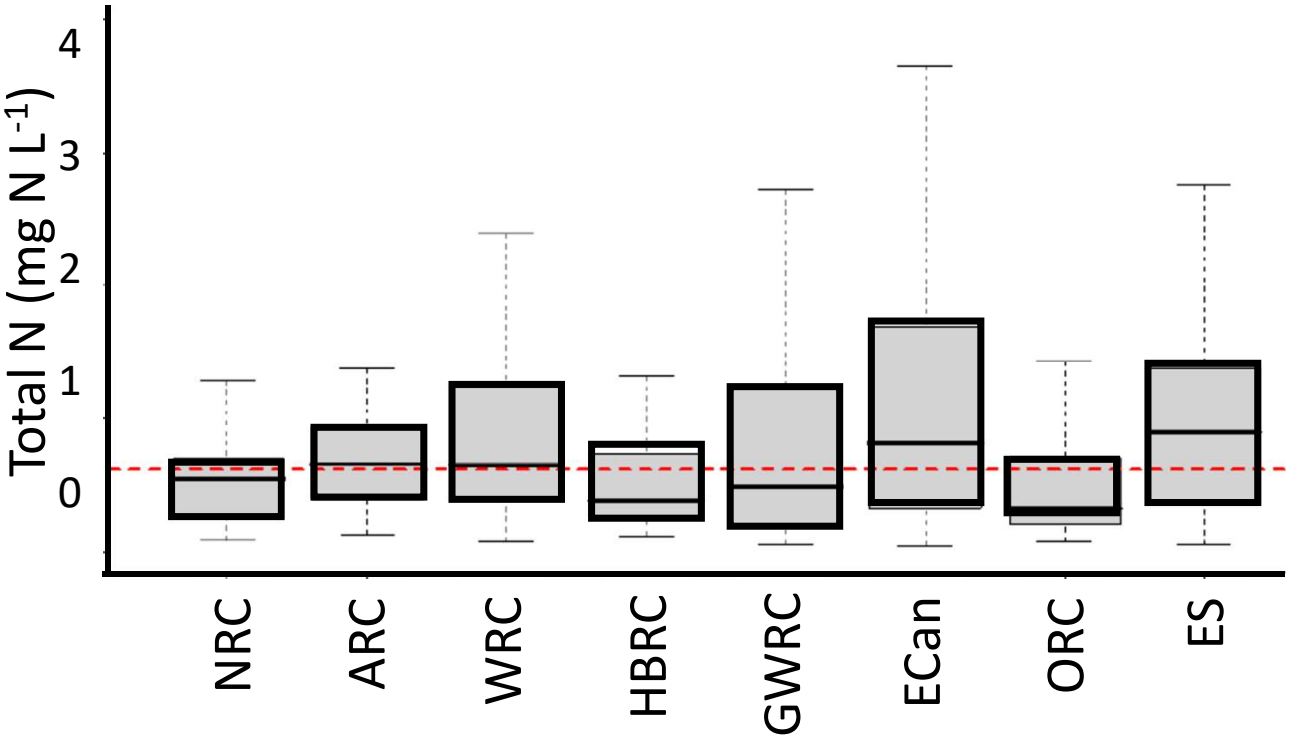
1. Preventing & reversing adverse effects of land use is very costly

2. Land users & rate payers are unwilling to meet those costs without evidence of effects

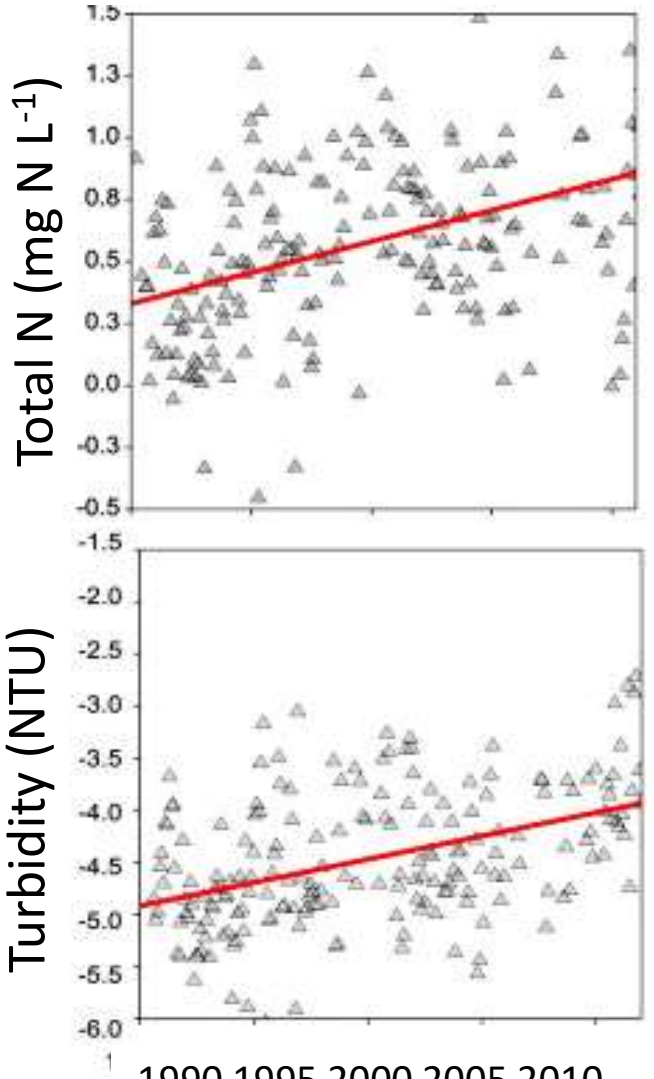
3. The strength of evidence required may increase if costs are concentrated into small groups of polluters

4. Strong evidence is needed to underpin policy & increase certainty of outcomes

Spatial and temporal patterns are not cause-and-effect relationships

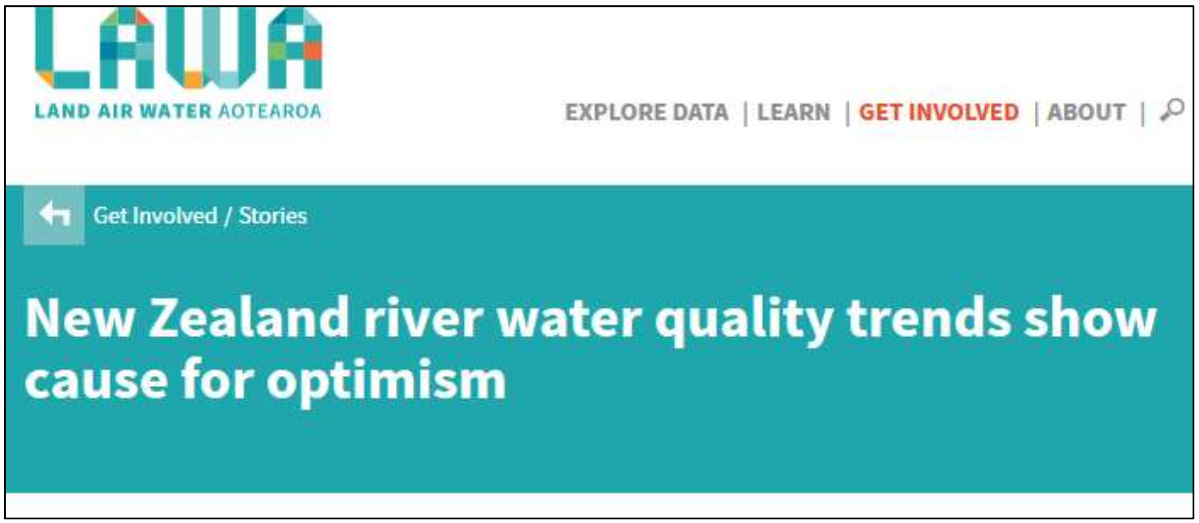


Ballantine et al. 2010. Analysis of river water quality data 1998-2007.



Smith et al. 2013 JHydrology 476:1-12

Reporting patterns without evidence of cause creates a vacuum



“The (LAWA) data seem to indicate cause for optimism: all the farmers’ and growers’ efforts -- fencing, planting, building shelters, upgrading effluent disposal and monitoring fertiliser use -- seem to be having an effect”.

-Rural News 17 May 2018

Relationships linking land and water use to effects in aquatic ecosystems

Claims

Once water-bottling extraction begins to deplete our aquifers and rivers that's when contamination begins.

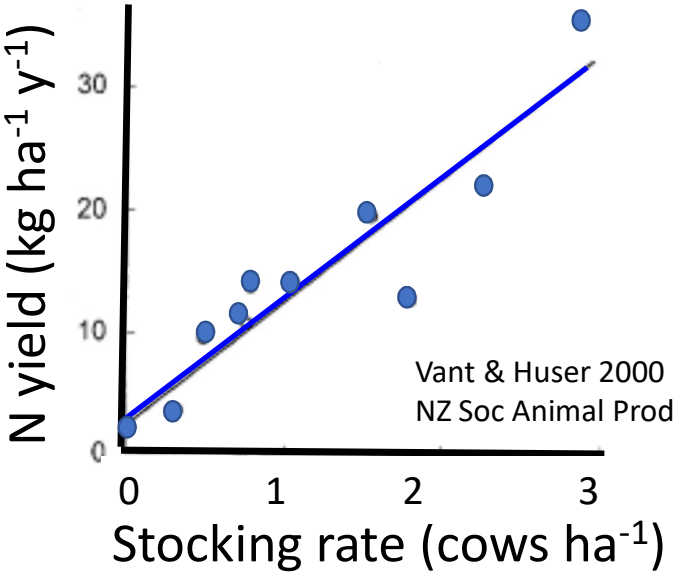
- *NZ Herald 22 August 2017*

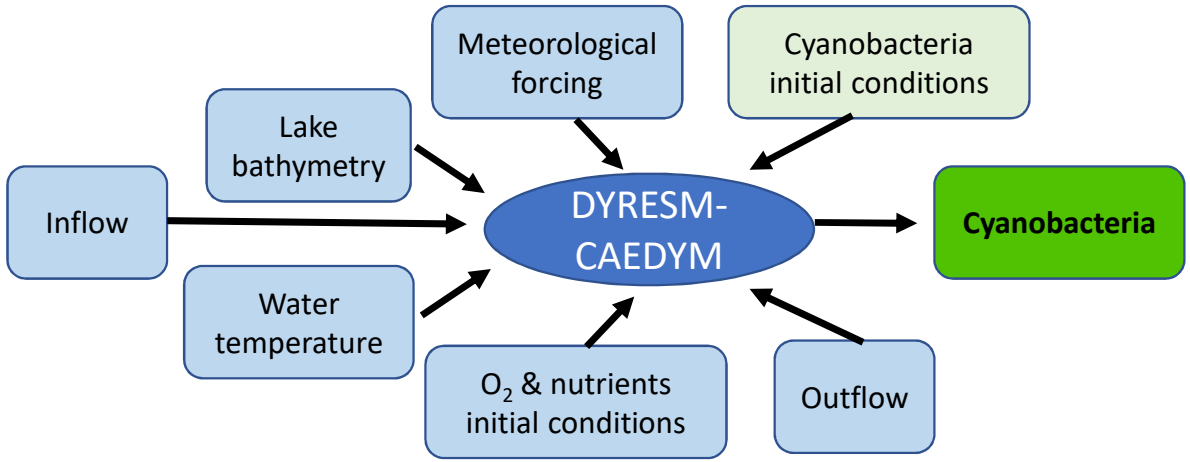
General principles

Dairy companies reported 26,953 km of measured Accord waterways, with 26,197 km of permanent stock exclusion (97.2%).

- *Sustainable Dairying – Water Accord 2017 progress report*

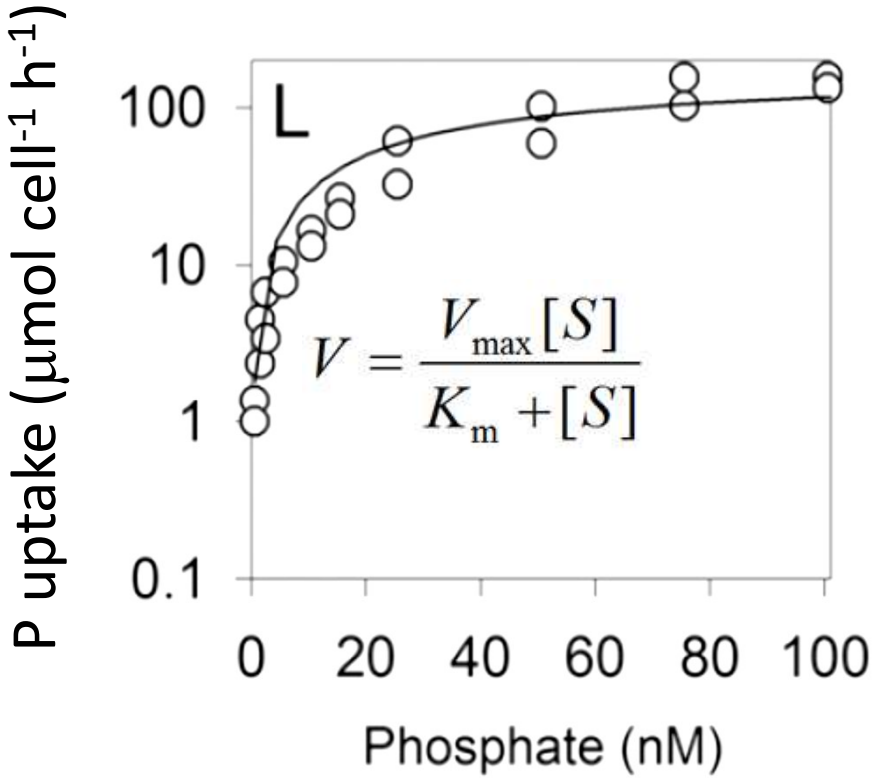
Cause-and-effect relationships

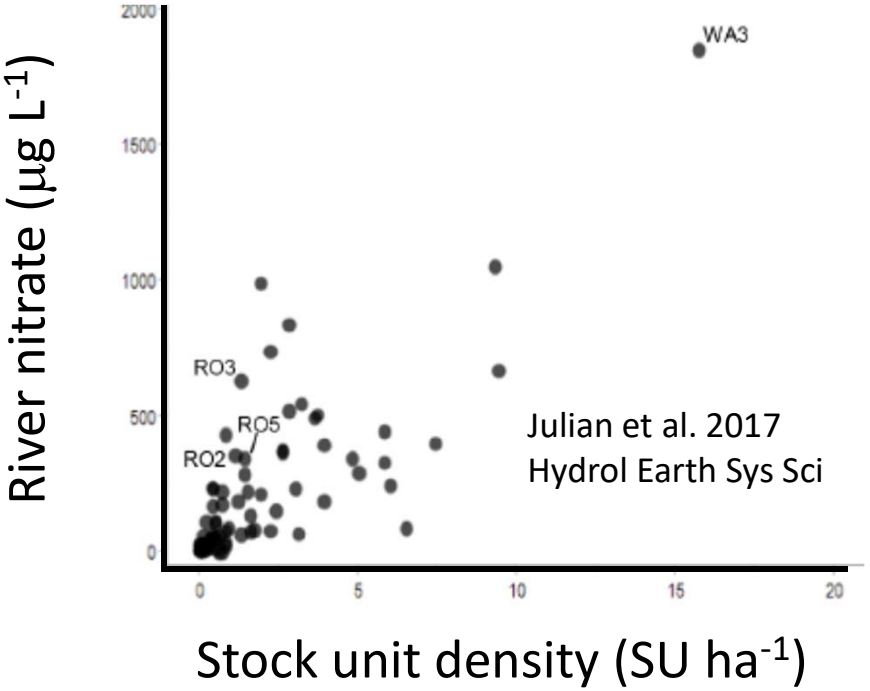


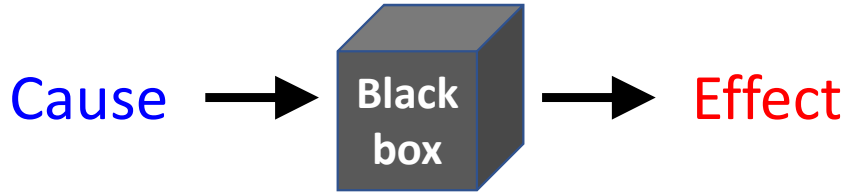


Process model to predict lake cyanobacteria

Cause-and-effect relationships – from reductionism to black boxes







Cause-and-effect relationships for land & water management - from reductionism to utility

Reliability

- Predictive power
- Reversibility
- Generality
- Plausibility

Feasibility

- Technical capacity
- Acceptability
- Cost/benefit balance
- Resource availability

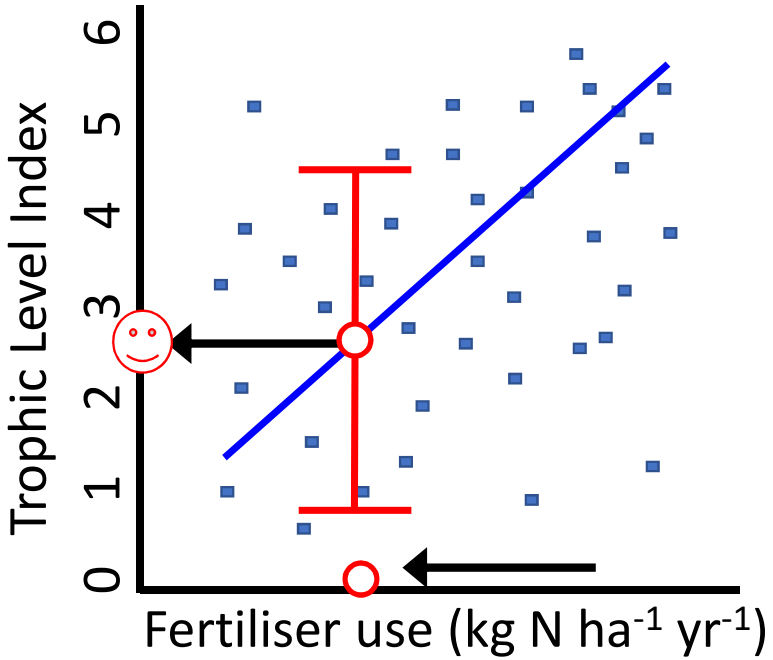
Reliability

Predictive power — Does variation in the cause account for much variation in the response?

Generality — Is the relationship applicable or transferable to many sites?

Reversibility — Does reduction of the cause reduce the adverse effect?

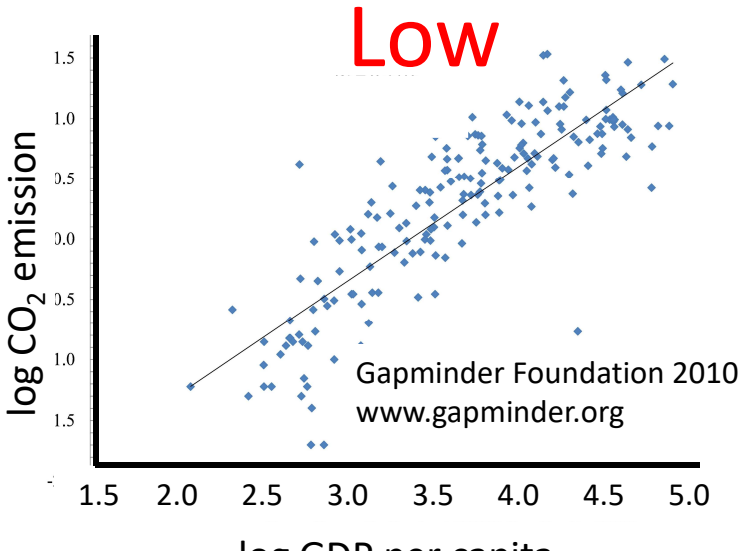
Plausibility — Is the relationship consistent with existing knowledge?

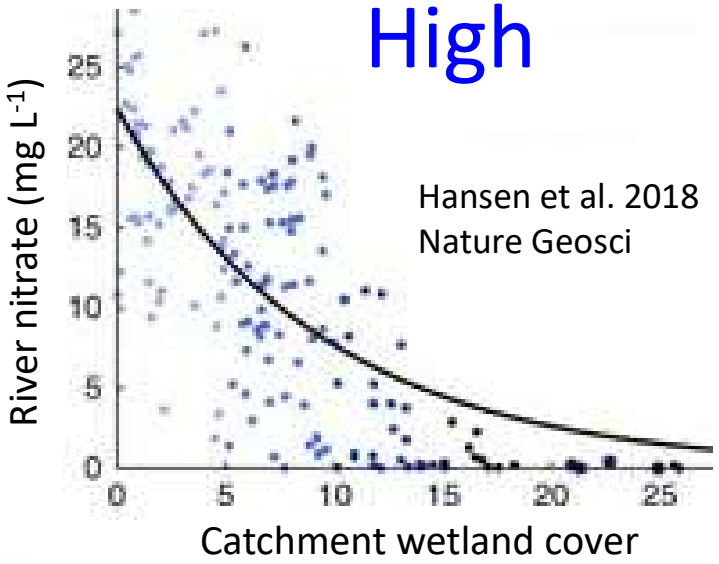


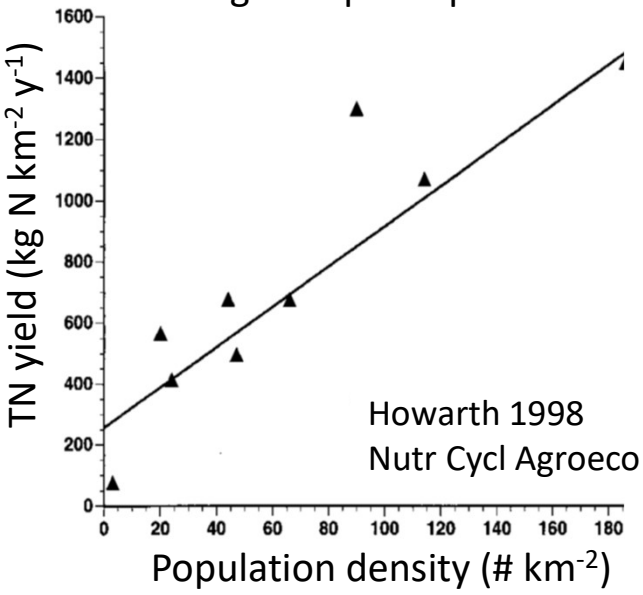
Low

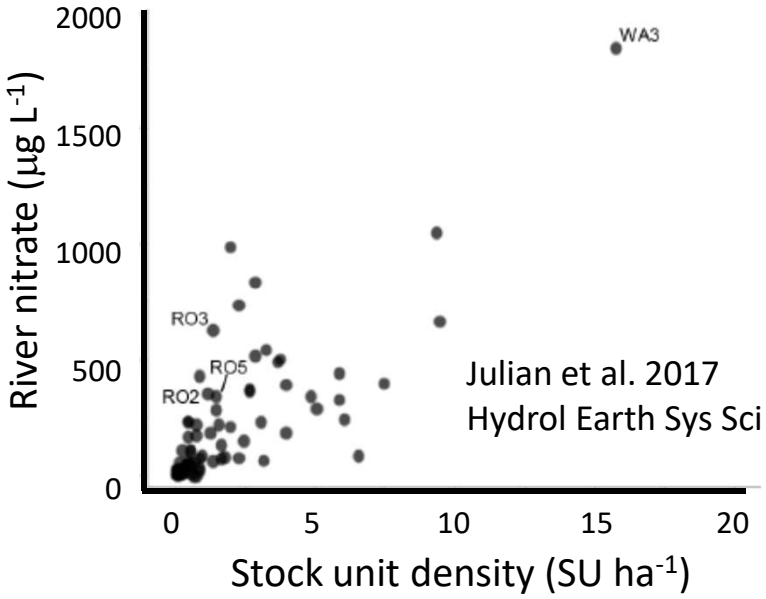
Feasibility

High





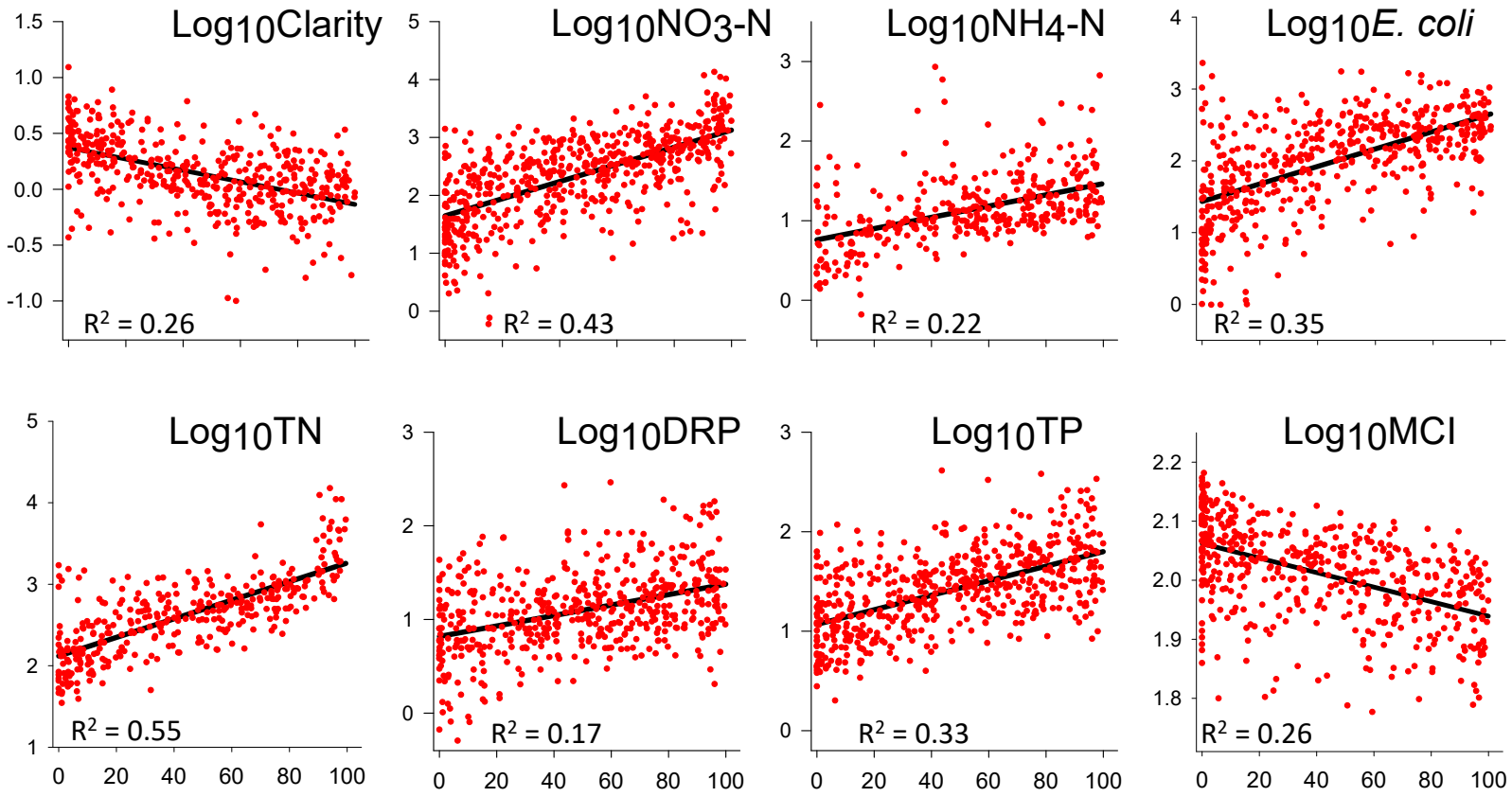




Land cover vs. land use vs. land-management practices as causes of land-use effects

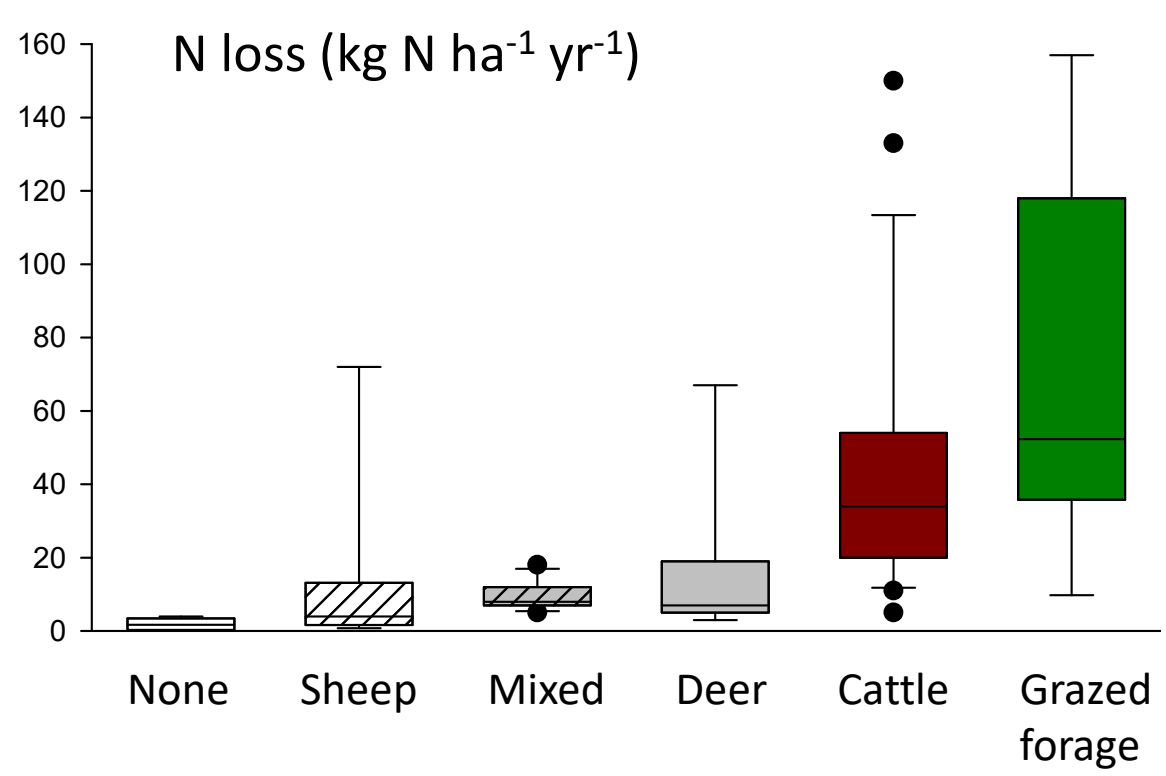
	Definition	Examples
Land cover	Observable features on the land surface	Exotic grassland, buildings, bare land, orchards
Land use	Purpose for which land is used	Deer farming, arable cropping, urban residential, fruit growing
Land management practices	Activities and inputs and outputs used to achieve a given land use	Fertiliser application, forest clear-felling, soil tillage, wetland treatment

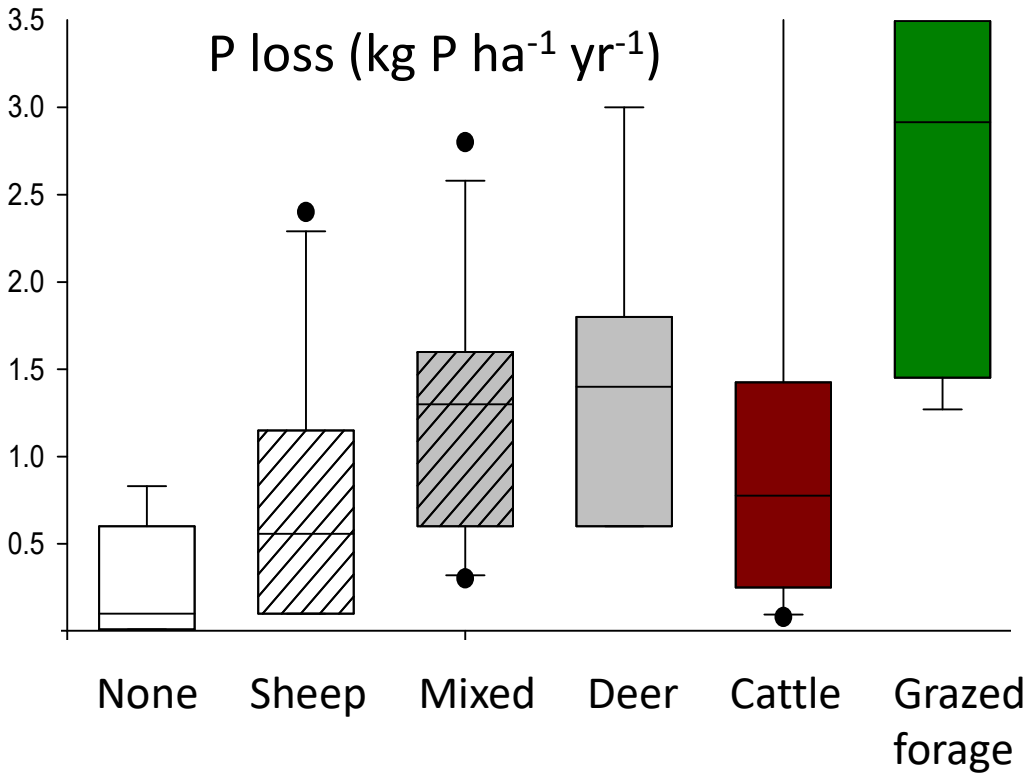
Evidence of land-use effects based on land-cover



Larned et al. 2016. NZJMFR

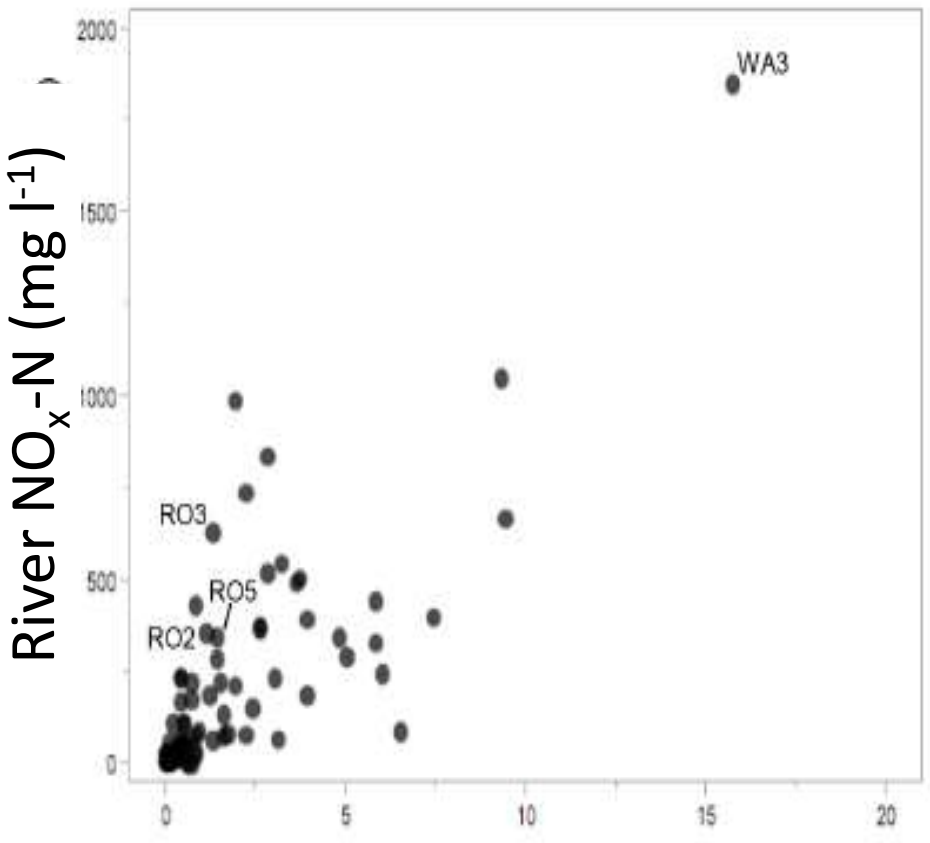
Evidence of land-use effects based on land-use classes

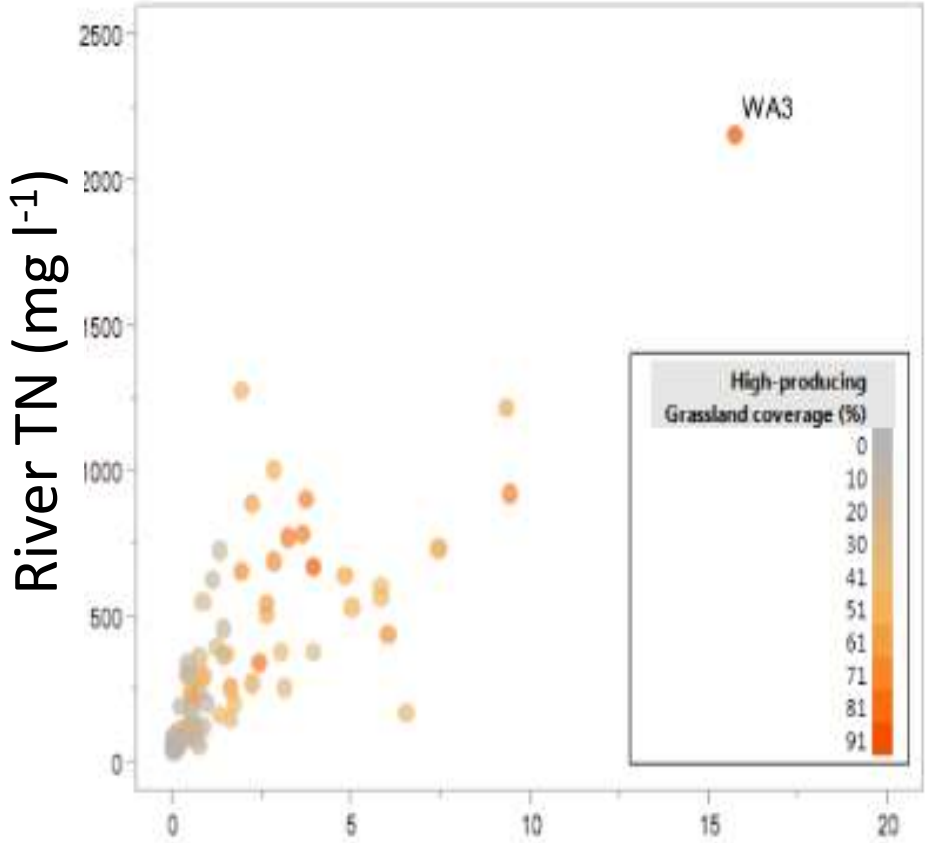




Larned et al. 2018. Review of land use effects. MfE report.

Evidence of land-use effects based on land management practices



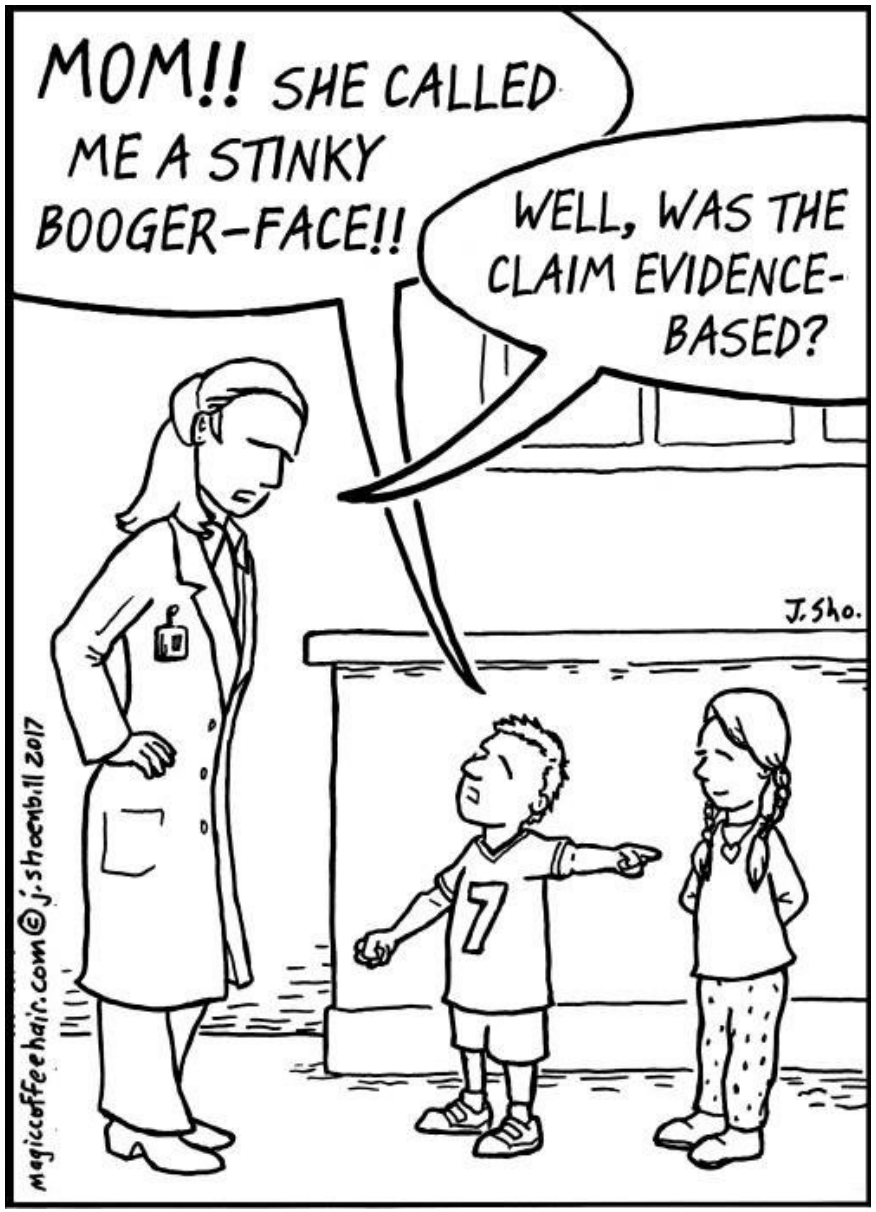


Dairy and beef stock unit density (SU ha^{-1})

Julian et al. 2017. HESS 21: 1149-1171.

Shifting from land cover to land management practices to strengthen evidence of land-use effects

	Data availability	Rate of change	Use in NZ	Reliability	Feasibility
Land cover	High	Slow	Good	Low	Low
Land use	Moderate	Moderate	Moderate	Moderate	Moderate
Land management practices	Low	High	Poor	High	High


MOM!! SHE CALLED ME A STINKY BOOGER-FACE!!
WELL, WAS THE CLAIM EVIDENCE-BASED?
J. Sho.
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Thank you