

How we failed to protect freshwater in New Zealand;  
will the new government initiatives make a  
difference?

Dr Mike Joy; Institute for Government and Policy Studies Victoria University

# Talk outline

- How much weight can we load on the plane? – would you have a zone committee or consultation process decide?
- Examples of the politicisation of freshwater science in New Zealand
- The consequences of the irrigation and dairy bonanza on environmental & human health, the economy and tourism
- The new action for healthy waterways initiative will it get us there?

# Every year it gets worse

## 'Bleak' report on Moutere catchment stream health sparks concern

Cherie Sivignon · 08:30, Jan 12 2019



Invercargill's gasping estuary can't wait for a sluggardly saviour

NEW ZEALAND / ENVIRONMENT

05:00, Jan 11 2019



### E coli closes popular swimming holes

NEW ZEALAND | Health 12:00 pm on 11 January 2019

Health warning as second lake succumbs to scum

### 100% Pure? New Zealand's Deteriorating Water Raises a Stink

By Reuters

### Health Warning: Unsafe Recreational Water Quality at Sandy Bay

© 2 minutes to / Health news / Health Warning: Unsafe Recreational Water Quality at Sandy B

## Waiau River's 'unmitigated environmental disaster'

Rachael Kelly · 05:00, Jan 13

Toxic wasteland takes over healthy Southland estuary

Jo McKenzie-McLean · 16:25, Jan 09 2019

### High E coli bacteria levels at Queenstown Bay

Paul Gorman · 17:26, Jan 06 2019



Boyack · 15:11, Jan 11 2019



### Popular Auckland beaches too polluted to swim in

27/12/2018 | Newshub reporter

Toxic algae appearing in Marlborough streams

11:20, Jan 05 2019

Campylobacter on watercress sees rāhui/ban placed on Kāpiti Coast stream

VIRGINIA FALLON · 10:03, Oct 26 2018



Dog owners and swimmers warned to watch for toxic algae in rivers

Nicholas Boyack · 15:11, Jan 11 2019



NEW ZEALAND / TARANAKI

### 'Conflict of interest' stops Taranaki councillors tackling algae

People swim at popular Whanganui lake despite warning signs

31 Dec, 2018 9:00am



## Toxic algae warning in Tasman

Skara Bohny · 12:30, Jan 13 2019



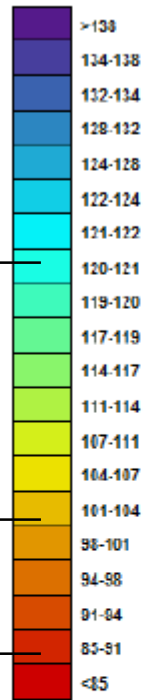
New Zealand summer December 2018/January 2019

Capital thinking. Globally minded.



# The problem picture

Semi-quantitative MCI



Healthy

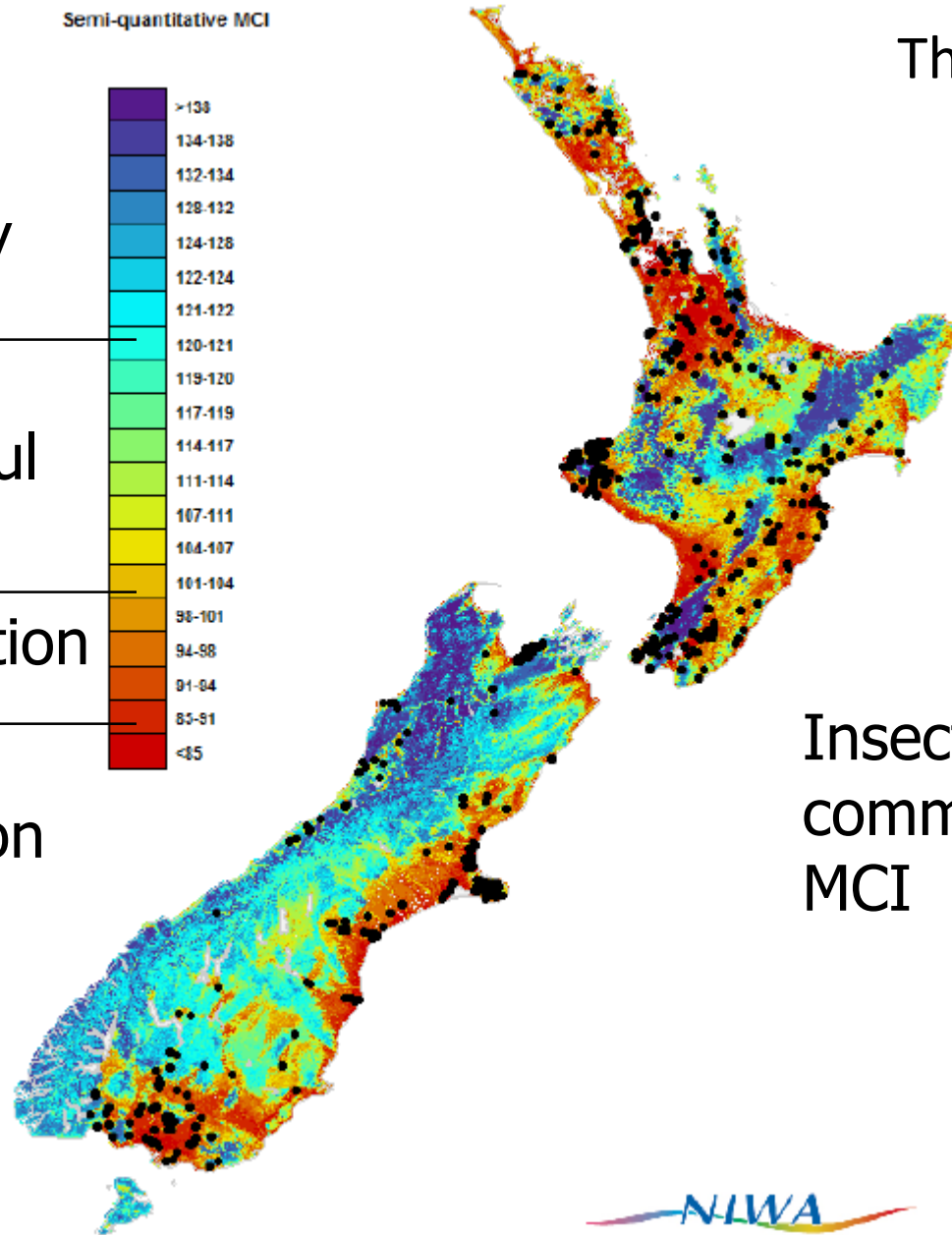


Doubtful

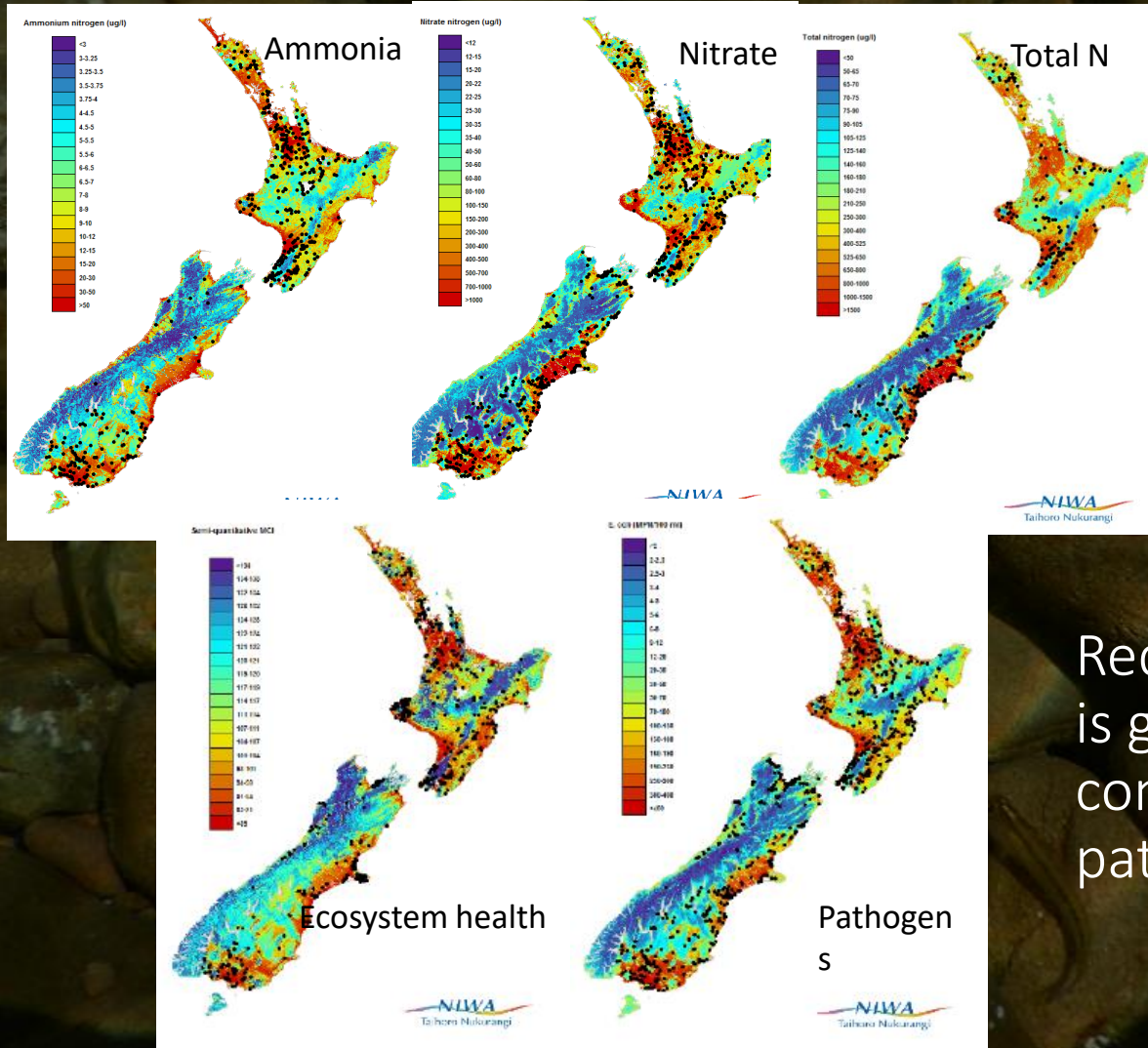
Moderate pollution



Severe pollution

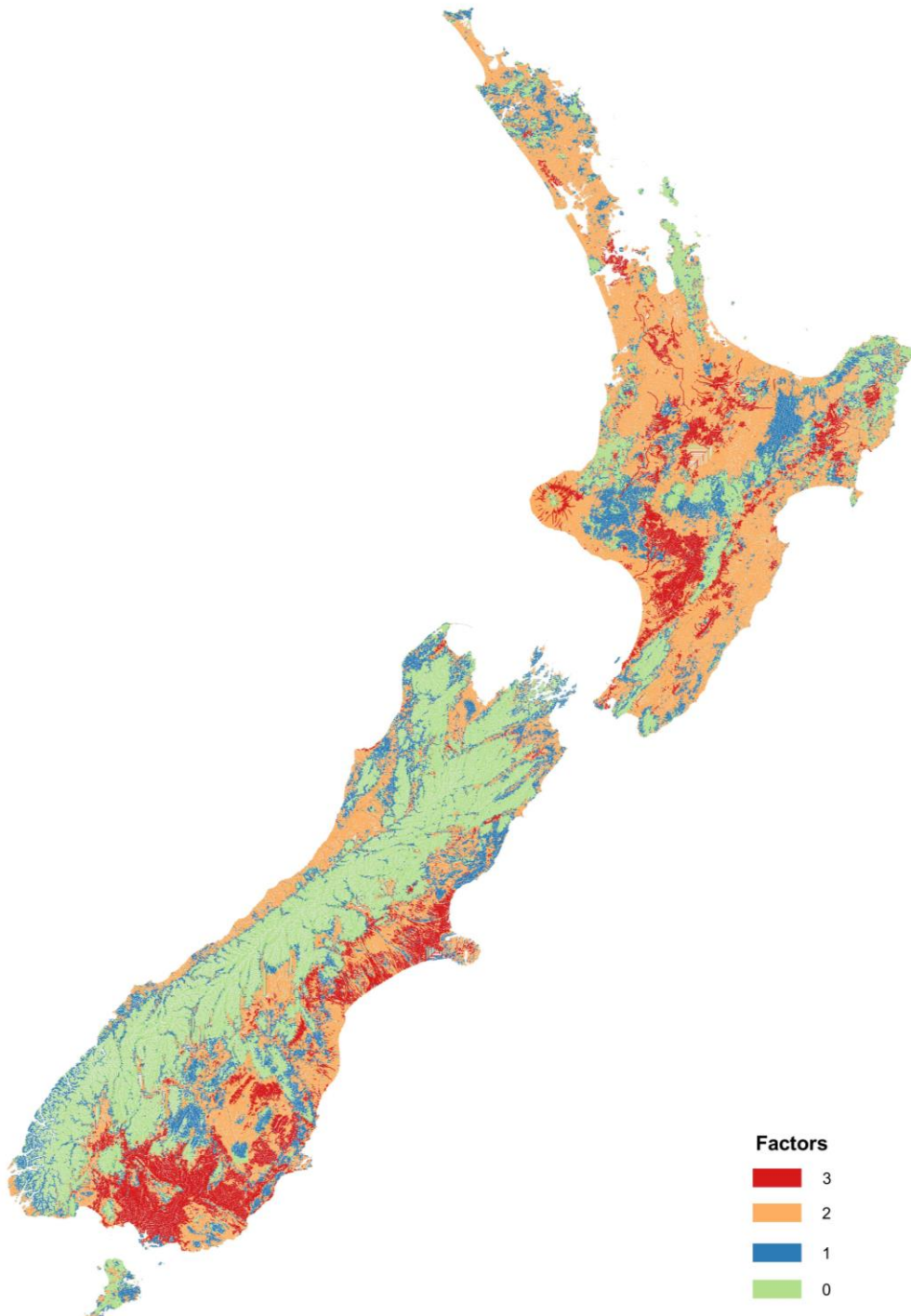


Insect  
community index  
MCI

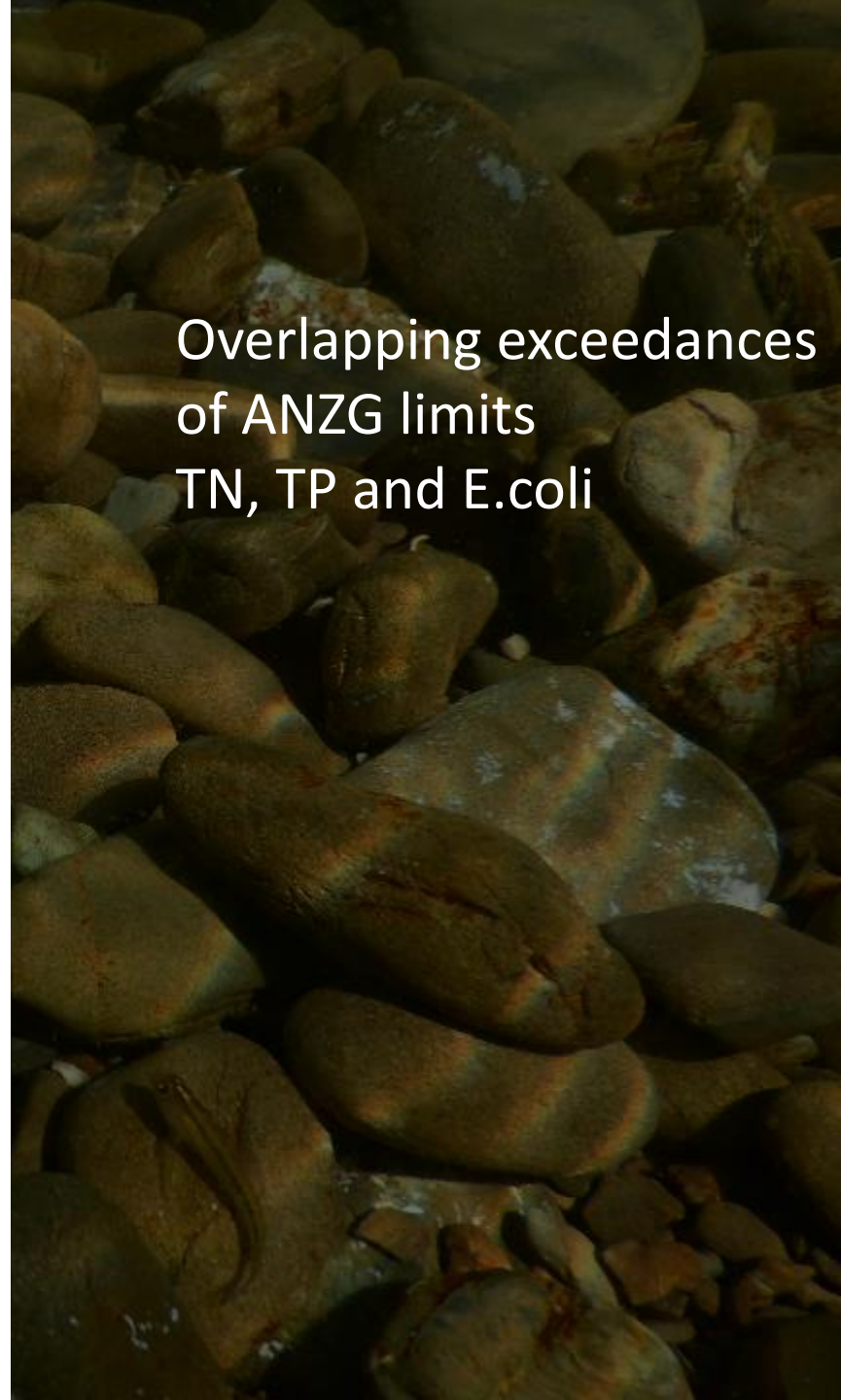


The state of freshwater in New Zealand

Red is bad, blue is good - See a consistent pattern here?

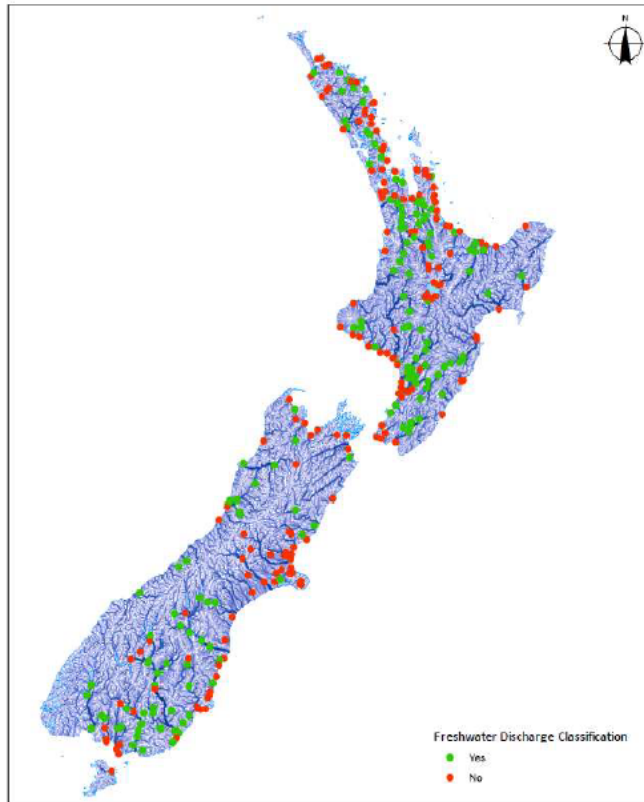


Overlapping exceedances  
of ANZG limits  
TN, TP and E.coli

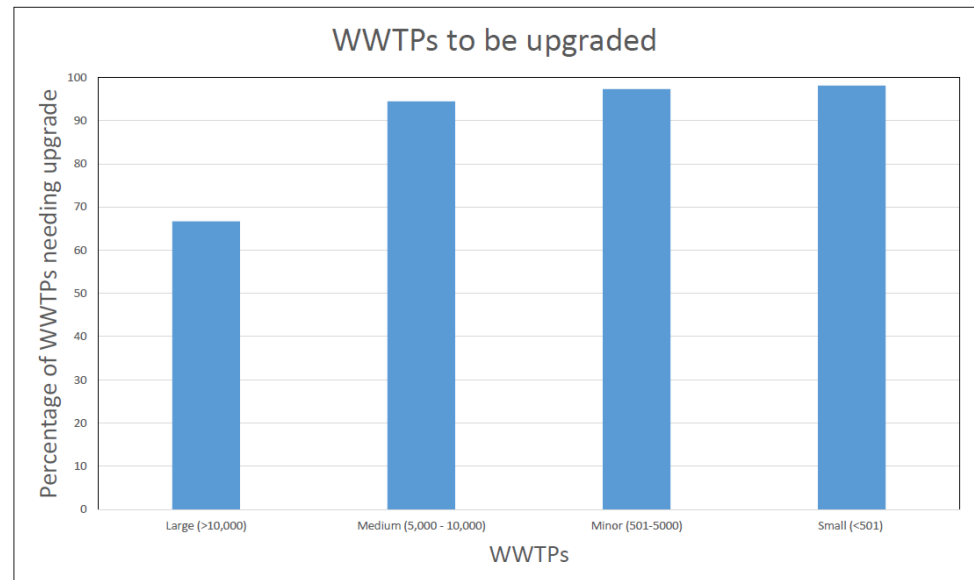


# Urban utter failure as well

152 out of 321 WWTPs discharge to freshwater  
(Average age of reticulation network = 35 years)



Only **7/152 WWTPs** do **not need an upgrade** to meet NPS Freshwater Attribute B at the discharge point



# Reading the RMA it all looks pretty clear to me; polluting rivers is not an option, so where did it all go wrong?

## 5 Purpose

(1) The purpose of this Act is to promote the sustainable management of natural and physical resources.

(2) In this Act, **sustainable management** means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety **while**—

- (a) **sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and**
- (b) **safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and**
- (c) **avoiding, remedying, or mitigating any adverse effects of activities on the environment.**

## 15 Discharge of contaminants into environment

(1) No person may discharge any—

- (a) **contaminant or water into water; or**
  - (b) **contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water; or**
  - (c) **contaminant from any industrial or trade premises into air; or**
  - (d) **contaminant from any industrial or trade premises onto or into land—**
- unless the discharge is expressly allowed by national environmental standards or other

## DEFINITION OF CONTAMINANT — SECTION 2 OF RMA

**contaminant** includes any substance (including gases, odorous compounds, liquids, solids, and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar, or other substances, energy, or heat—

- (a) **when discharged into water, changes or is likely to change the physical, chemical or biological condition of water;**

## 7 Duty to avoid, remedy, or mitigate adverse effects

1) Every person has a duty to avoid, remedy, or mitigate any adverse effect on the environment arising from an activity carried on by or on behalf of the person, whether or



local government failure to enforce from 1990 – 2014 then Central Govt. weakening of limits to support more agricultural intensification



# Our freshwater crisis – the causes



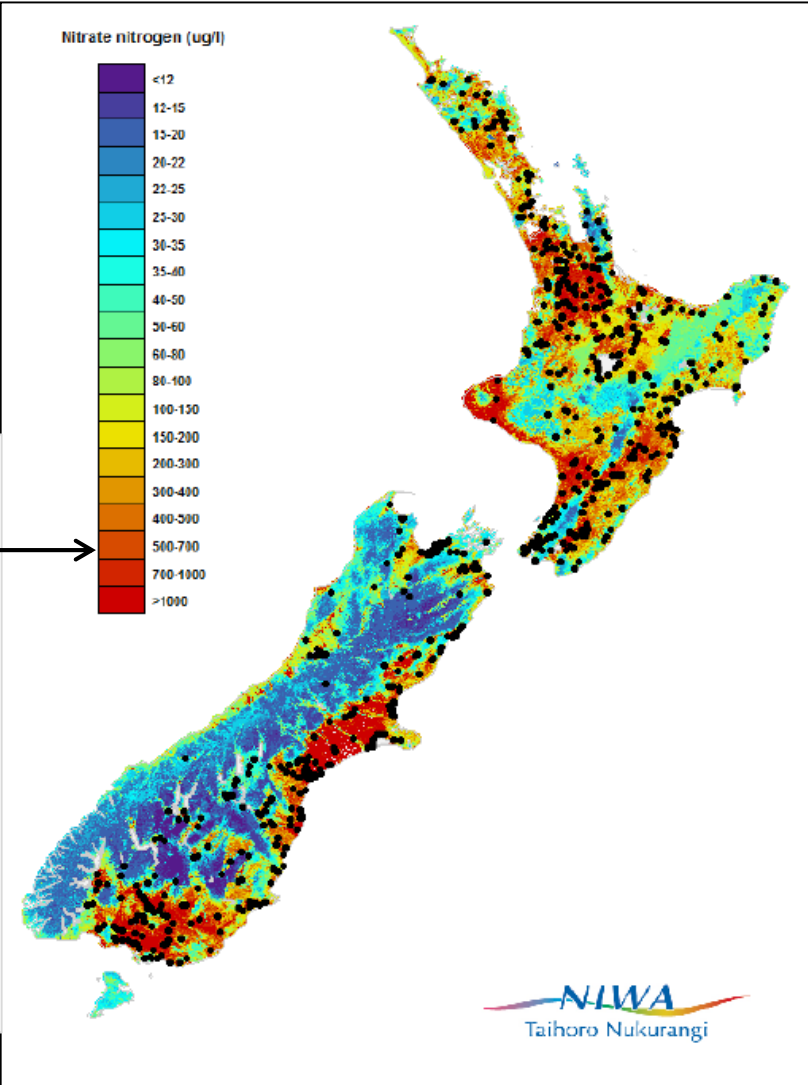
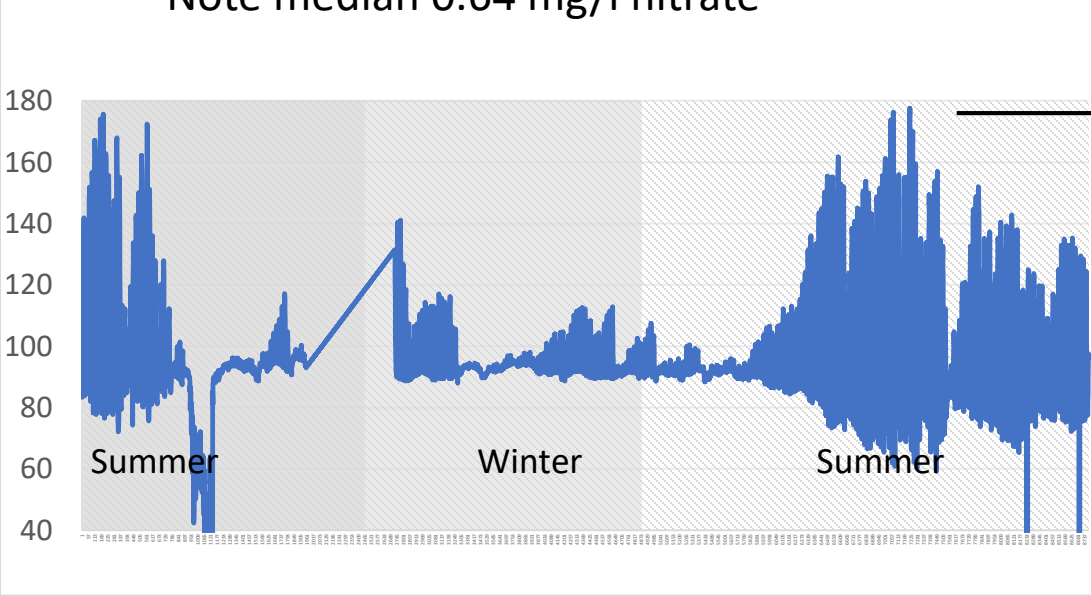
“The greatest negative impact on river water quality in NZ in recent decades has been high-producing pastures that require large amounts of fertiliser to support high densities of livestock”

Julian, J.P., de Beurs, K.M., Owsley, B., Davies-Colley, R.J., and Ausseil, A.G.E. (2017) River water quality changes in New Zealand over 26 years: response to land use intensity. *Hydrology and Earth System Sciences* 21(2), 1149-1171. (page 1167)

Why nitrate aquatic toxicity? (the NPS-FM reasoning for limits as opposed to ecosystem health) is not an issue (yet) example of politics over science to allow intensification



% dissolved oxygen Hopelands Road  
Manawatu River  
Feb 2017 - Feb 2018  
Note median 0.64 mg/l nitrate



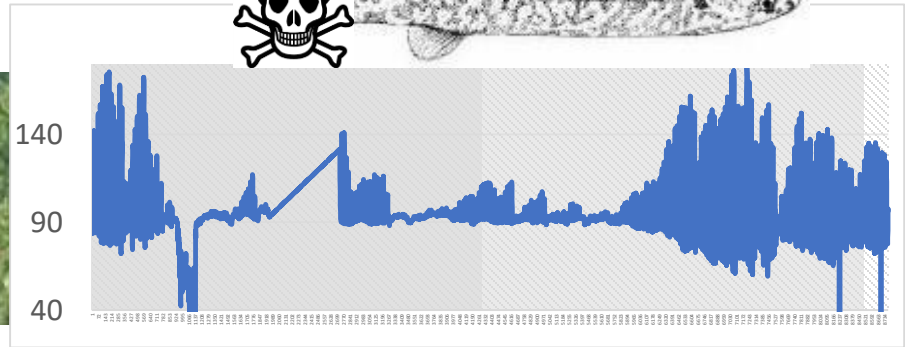
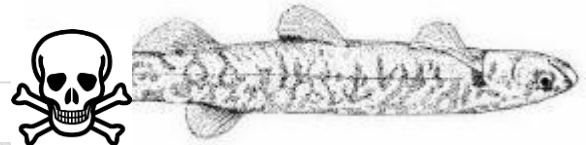


Drinking water MAV 11.3 mg/l from WHO blue baby syndrome



# River water

NPS-FM rivers bottom line aquatic nitrate toxicity 6.9 mg/l



Median value Hopelands Road site 0.64 mg/l

ANZECC guideline limit to protect river ecosystems 0.44



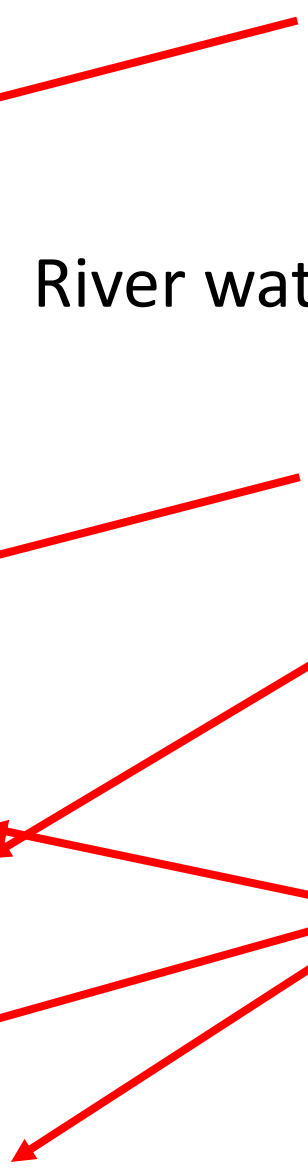
Drinking water MAV 11.3 mg/l from WHO blue baby syndrome

## River water previous government response



NPS-FM rivers bottom line nitrate aquatic toxicity 6.9 mg/l  
CWMS limit half nitrate toxicity 3.8 mg/l

NPS-FM NOF bands A, B & C



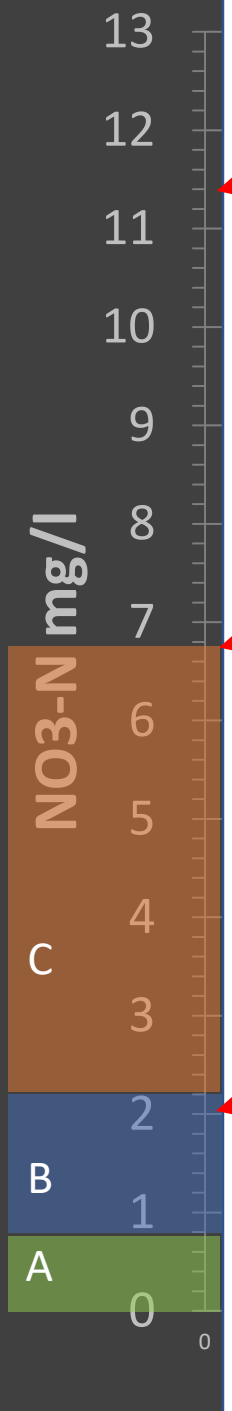


Drinking water MAV 11.3 mg/l from WHO blue baby syndrome

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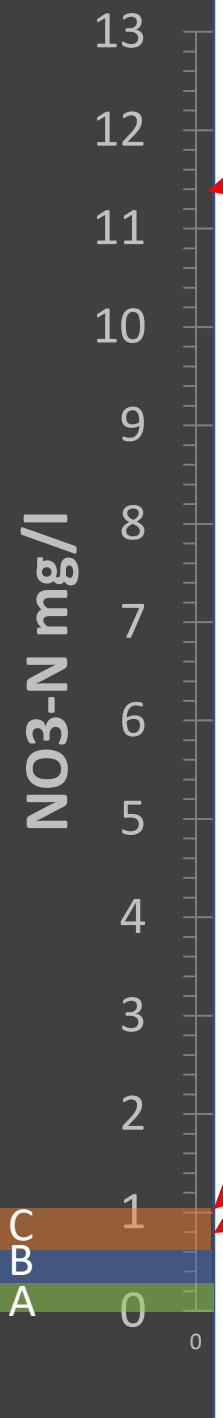
The Yangtze & Mississippi rivers





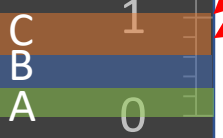
Drinking water MAV 11.3 mg/l from WHO blue baby syndrome

# River water current government proposal from STAG



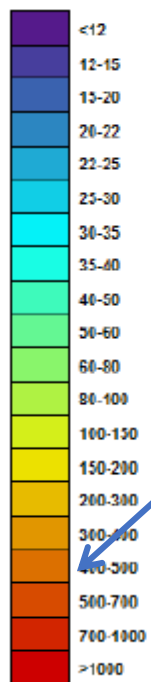
NPS-FM rivers bottom line ~ 1 mg/l

NPS-FM NOF bands A, B & C

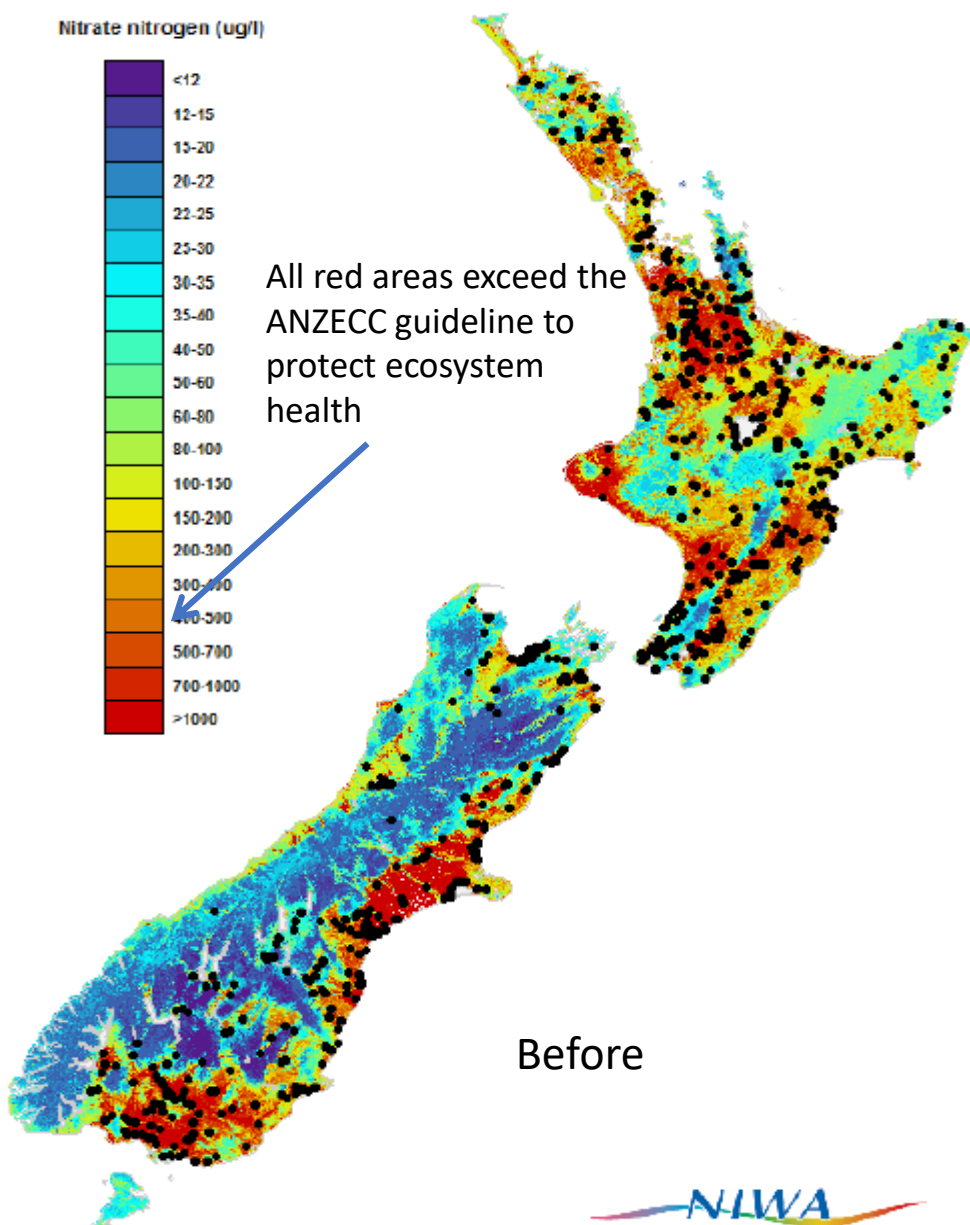


# "A fresh start for freshwater" NPS objectives 2014: (making the problem disappear)

Nitrate nitrogen (ug/l)



All red areas exceed the ANZECC guideline to protect ecosystem health



Before

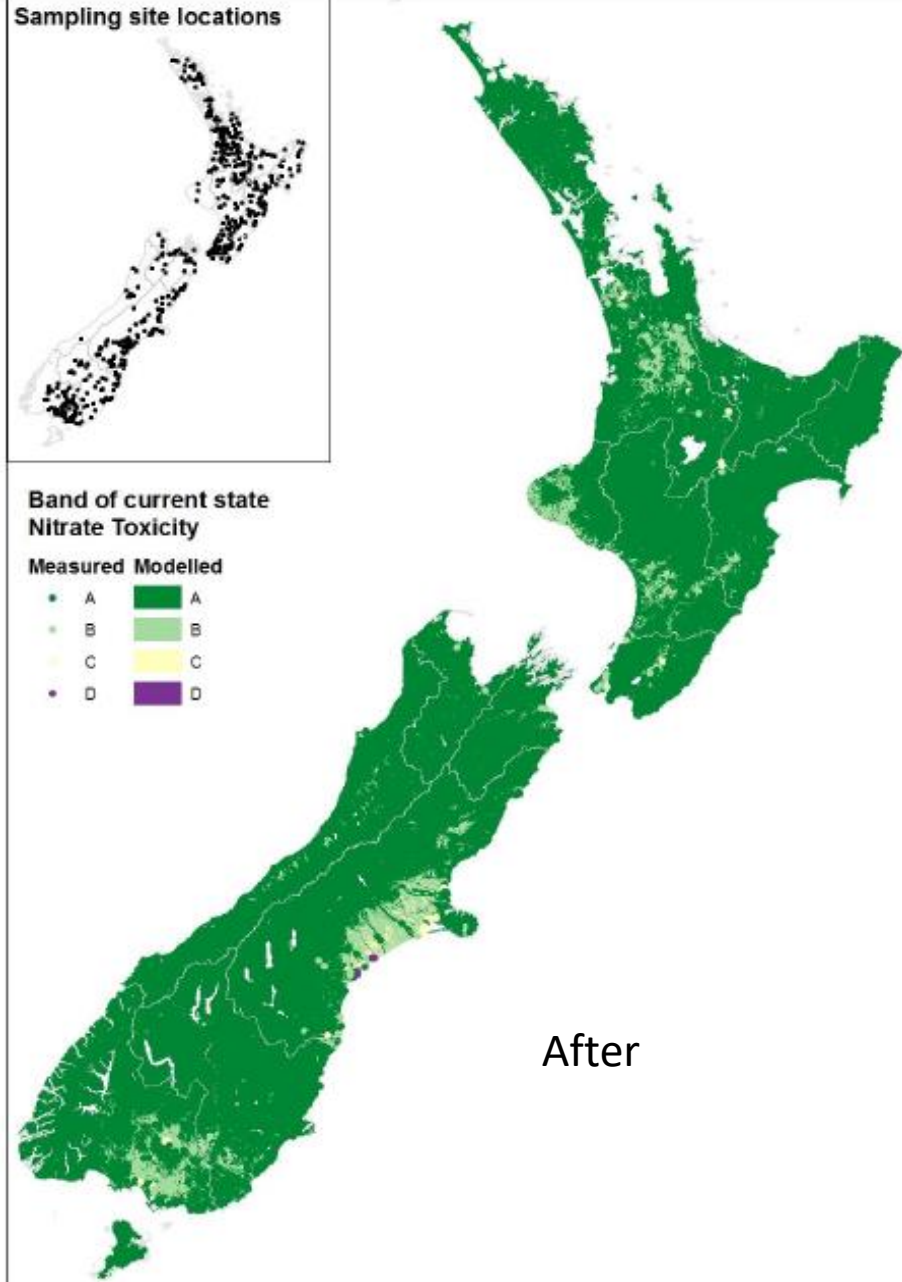
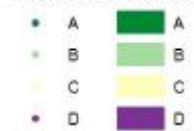


Sampling site locations



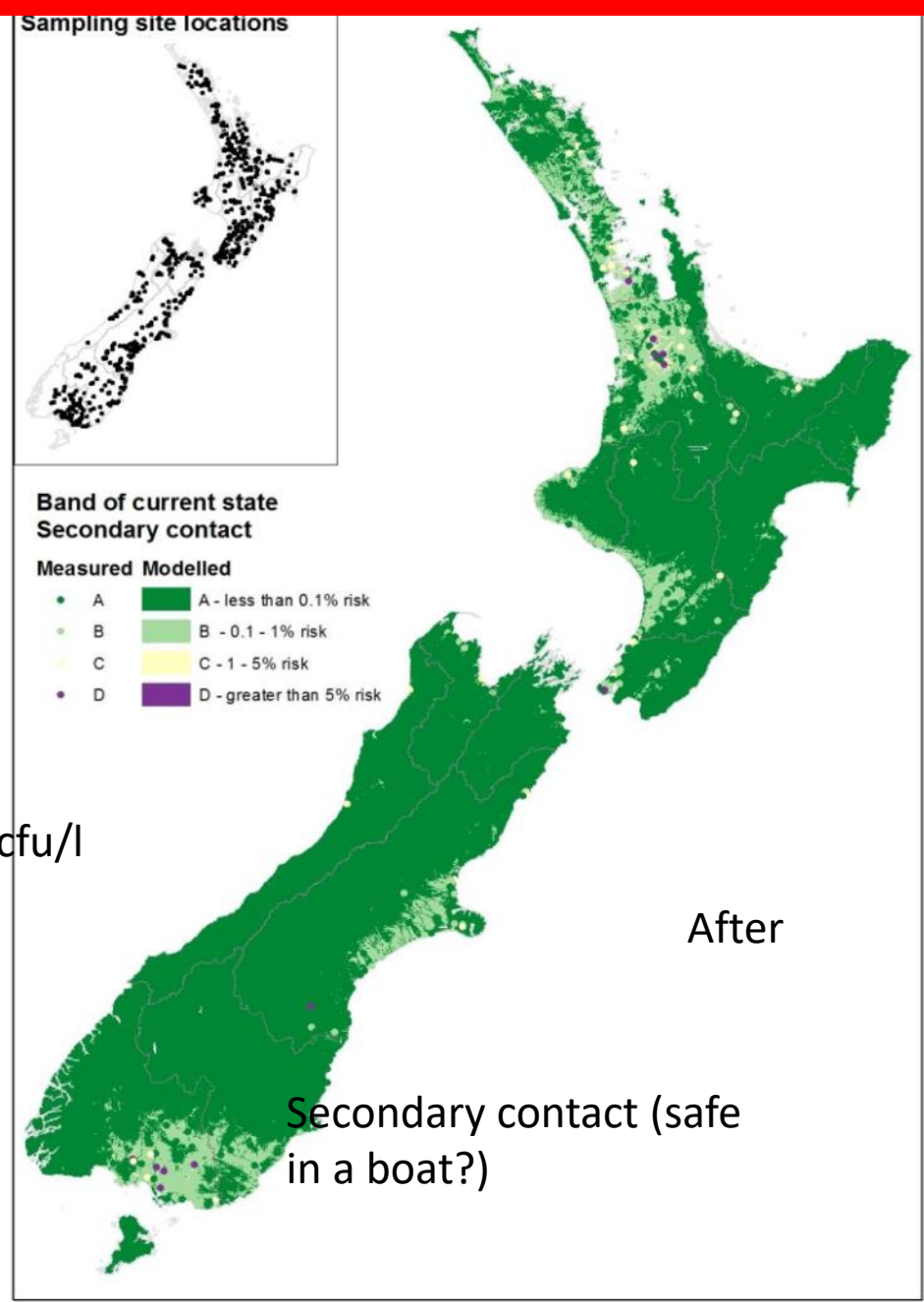
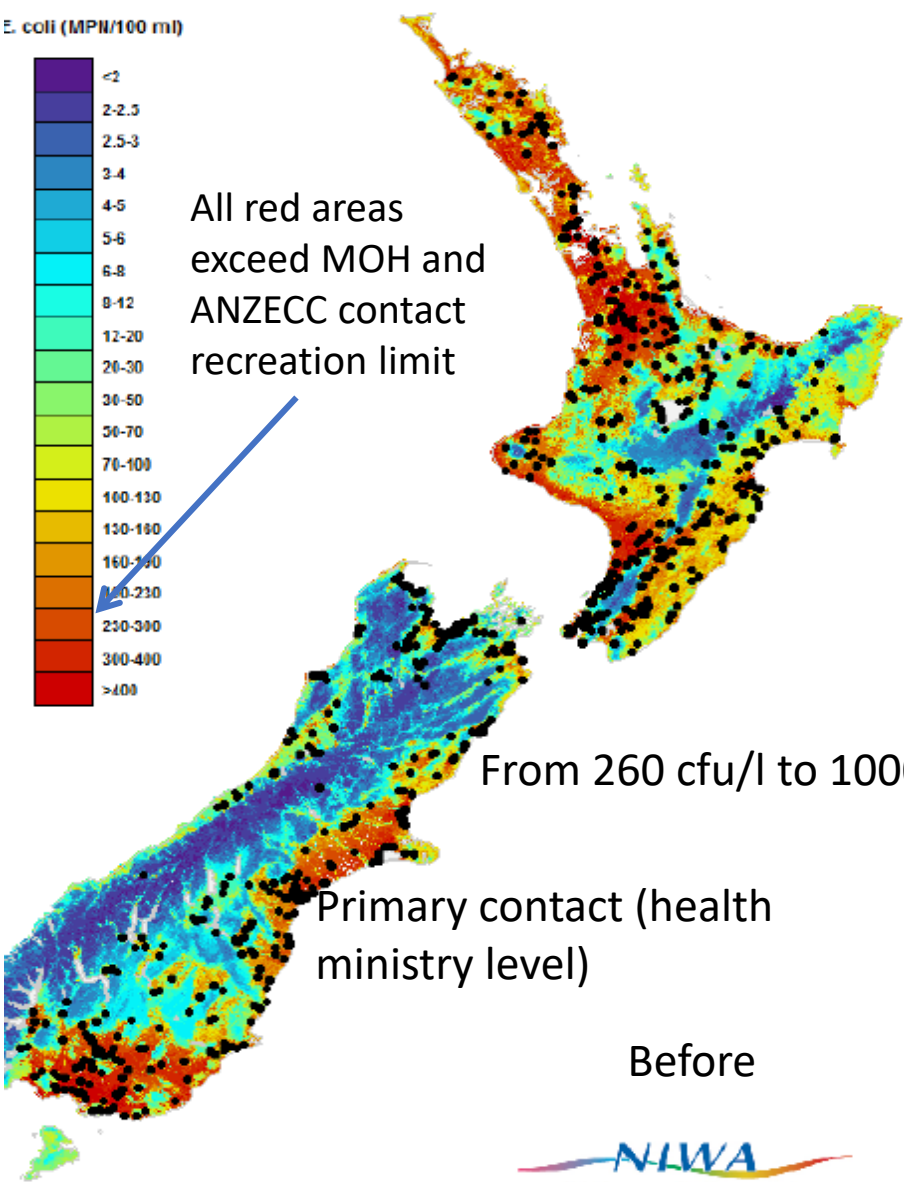
Band of current state Nitrate Toxicity

Measured Modelled



After

# "A fresh start for freshwater" NPS objectives 2014: (making the problem disappear)





Another example of how water management is about politics/spin not science

# Clean Water

90% of rivers and lakes swimmable by 2040

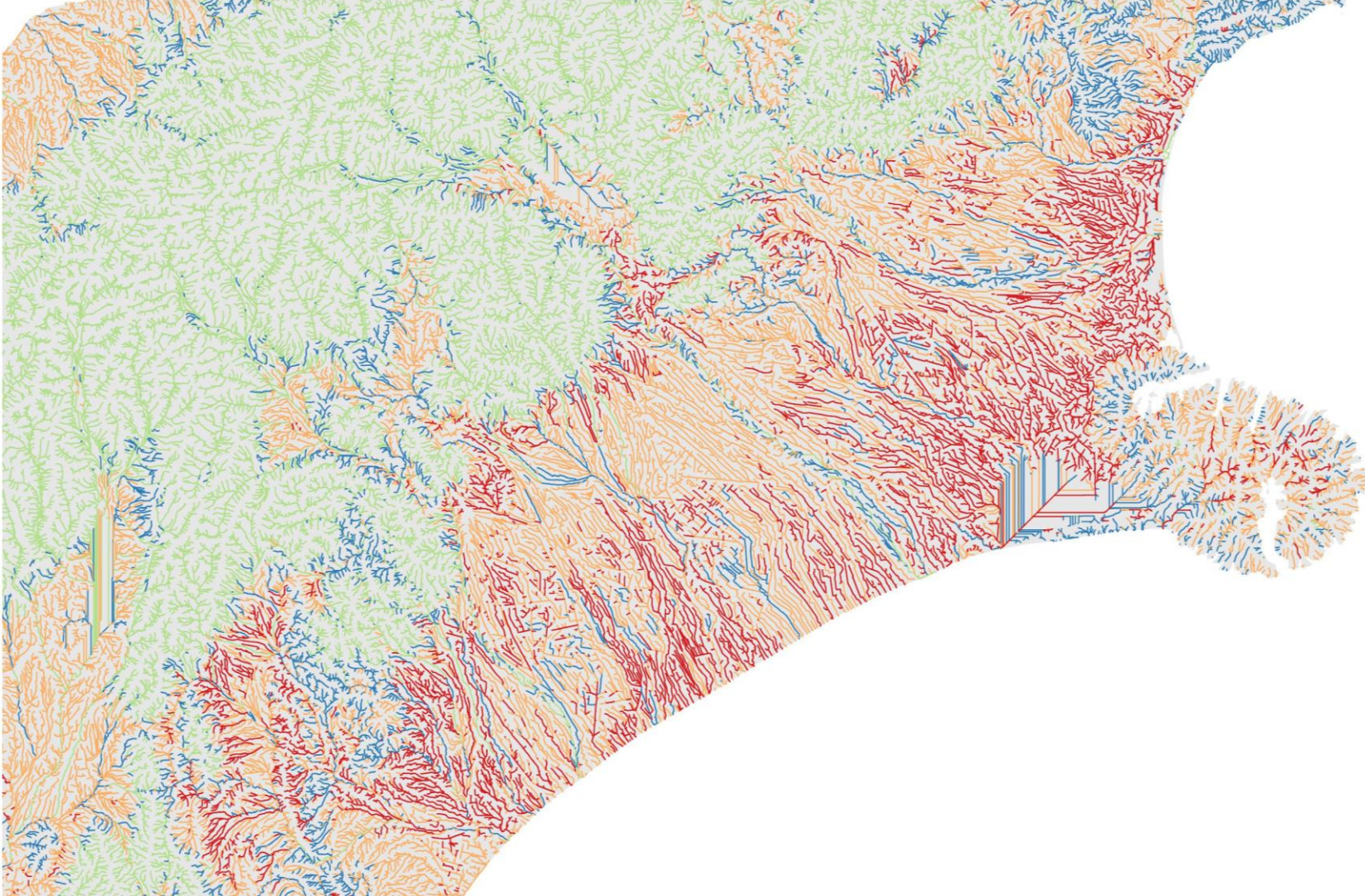
80% swimmable by 2030 & 90% swimmable by 2040

BUT:

1. Only applies to lakes > 1.5km diameter (25% of lakes)
2. Only applies to >4<sup>th</sup> order waterways and that is ~12% of length if NZ waterways, 70% of them already swimmable so goal is actually 20% of 12 %
3. Limits shifted of 76 NWRQN sites number of sites swimmable under original NPS 42%, under Clean Water 83% (NB, USEPA 49%)



**River Water Quality Modelled State 2013-2017 -  
Total number of factors not meeting ANZG  
standards for Total Nitrogen, Total Phosphorus,  
and E. coli**



# The consequences of allowing nitrate in water to increase

THE CONVERSATION

GLOBAL PERSPECTIVES

Academic rigour, journalistic flair

Arts + Culture Business + Economics



IJC

International Journal of Cancer

## Nitrate in drinking water and colorectal cancer risk: A nationwide population-based cohort study

Jörg Schullehner <sup>1,2,3,4</sup>, Birgitte Hansen<sup>2</sup>, Malene Thygesen<sup>3,4</sup>, Carsten B. Pedersen<sup>3,4</sup> and Torben Sigsgaard<sup>1</sup>

<sup>1</sup> Department of Public Health, Aarhus University, Aarhus, Denmark

<sup>2</sup> Department of Groundwater and Quaternary Geology Mapping, Geological Survey of Denmark and Greenland, Aarhus, Denmark

<sup>3</sup> National Centre for Register-Based Research, Department of Economics and Business Economics, School of Business and Social Sciences, Aarhus University, Aarhus, Denmark

<sup>4</sup> Centre for Integrated Register-based Research, CIRRAU, Aarhus University, Aarhus, Denmark

Drinking water study raises health concerns for  
New Zealanders

<https://theconversation.com/drinking-water-study-raises-health-concerns-for-new-zealanders-108510>

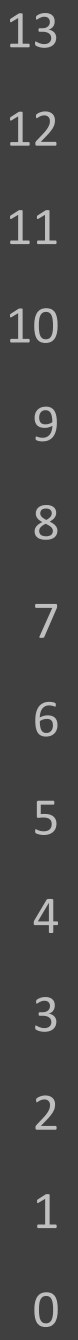
Capital thinking. Globally minded.



Drinking water MAV 11.3 mg/l from WHO blue baby syndrome

# Groundwater

NO<sub>3</sub>-N mg/l



ANZECC guidelines 7.5 mg/l for aquatic toxicity

CWMS limit half nitrate toxicity 3.8 mg/l

The threshold groundwater value 2.5 mg/L NO<sub>3</sub>-N for indication of high intensity land-use impact

The threshold groundwater value 2.1 mg/L NO<sub>3</sub>-N for 15% increase in risk of colorectal cancer

ANZECC guidelines 1.7 mg/l for aquatic species protection

The threshold groundwater value 0.87 mg/L NO<sub>3</sub>-N for significant increase in risk of colorectal cancer

- A critique of ECANs reporting on nitrate similar issues at all regional councils – measuring the wrong things the wrong way and gilding the lily



# Annual Groundwater Quality Survey 2018

red squares represent concentrations that exceeded the MAV. The light blue coloured squares indicate samples below 3 mg/L, which is the expected natural range for nitrate in New Zealand groundwater without human impact (Daughney and Reeves, 2005; Morgenstern and Daughney, 2012).

This is what Morgenstern and Daughney 2012 actually said:

...indication of land-use impact that was found by Daughney and Reeves (2005) by purely statistical analysis without information on groundwater ages, with thresholds of 1.6 and 3.5 mg/L for “probable” and “almost certain” land-use impact, respectively.

Somehow ECAN turn that into ‘3 mg is natural without human impact’  
3mg/l! the real natural would be well under 1mg as suggested by references  
and can be seen by some deep bores now

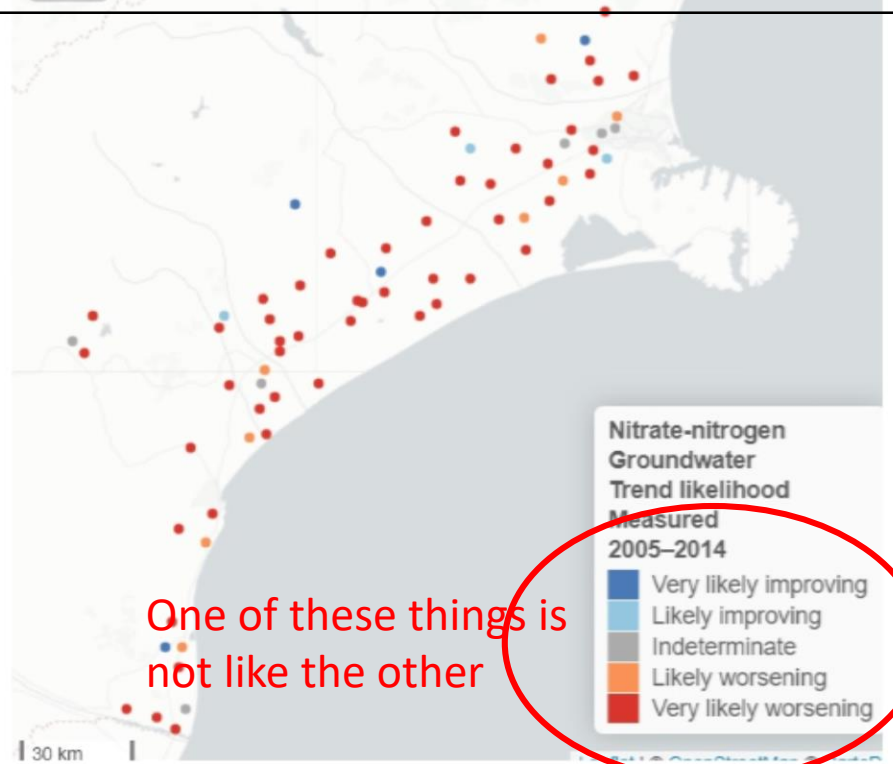
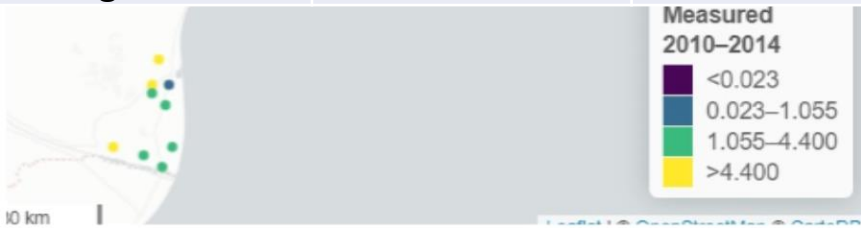
# More ECAN hide the reality examples – politicisation of science

*ECAN \_ From the 2009 to 2018 annual surveys we found:*

- nitrate nitrogen concentrations have been increasing in 42 (about 18%) of those wells over the past ten years.
- 11 wells (5%) showed decreasing nitrate concentration trends.
- 176 wells (77%) had no decreasing or increasing trend in nitrate concentrations.

From statistics NZ and

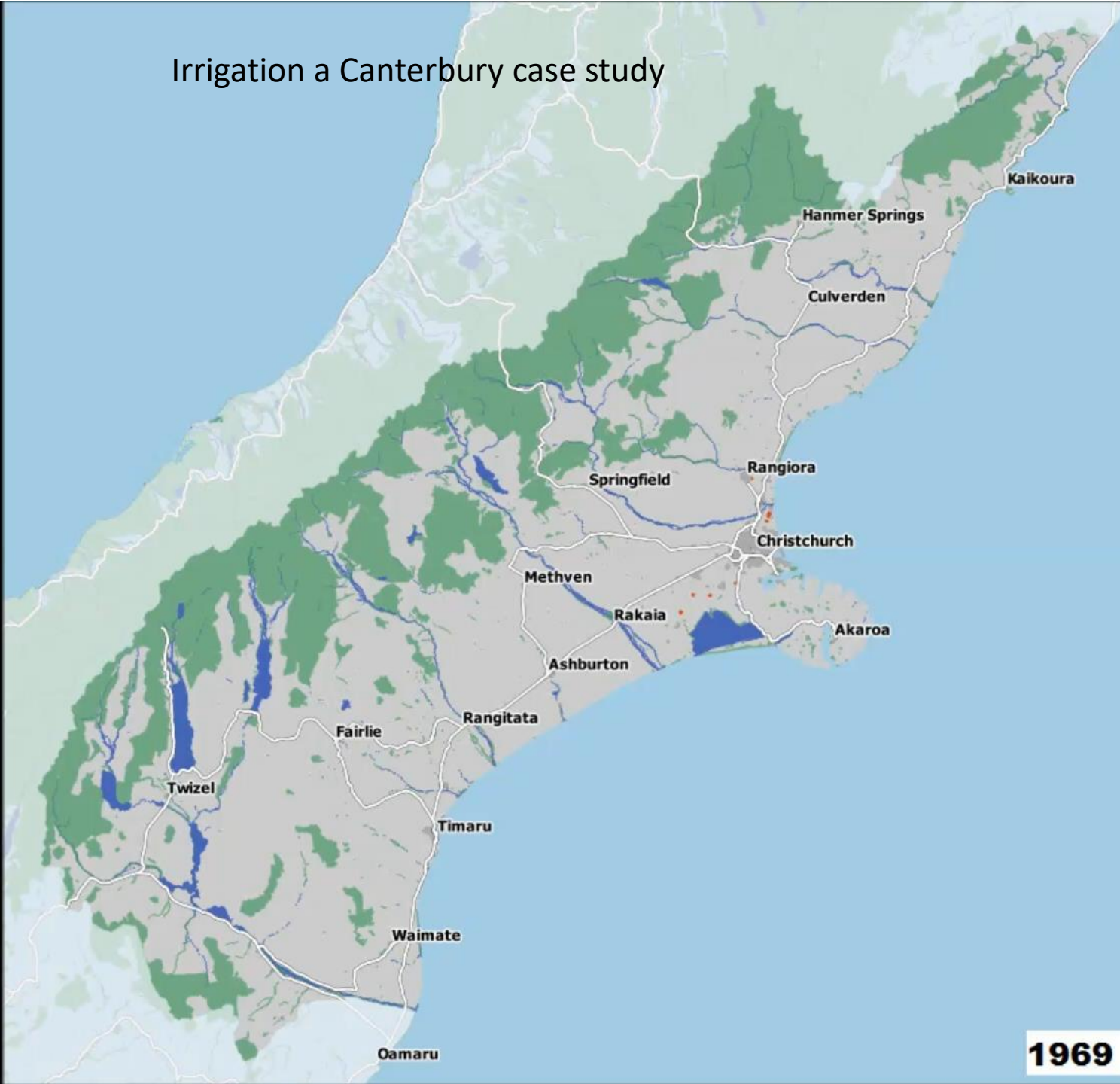
Status	ECAN reporting	Industry standard reporting
Getting worse	<b>18%</b>	<b>66%</b>
Getting better	<b>5%</b>	<b>20%</b>
No Change	<b>77%</b>	<b>16%</b>



One of these things is not like the other



# Irrigation a Canterbury case study

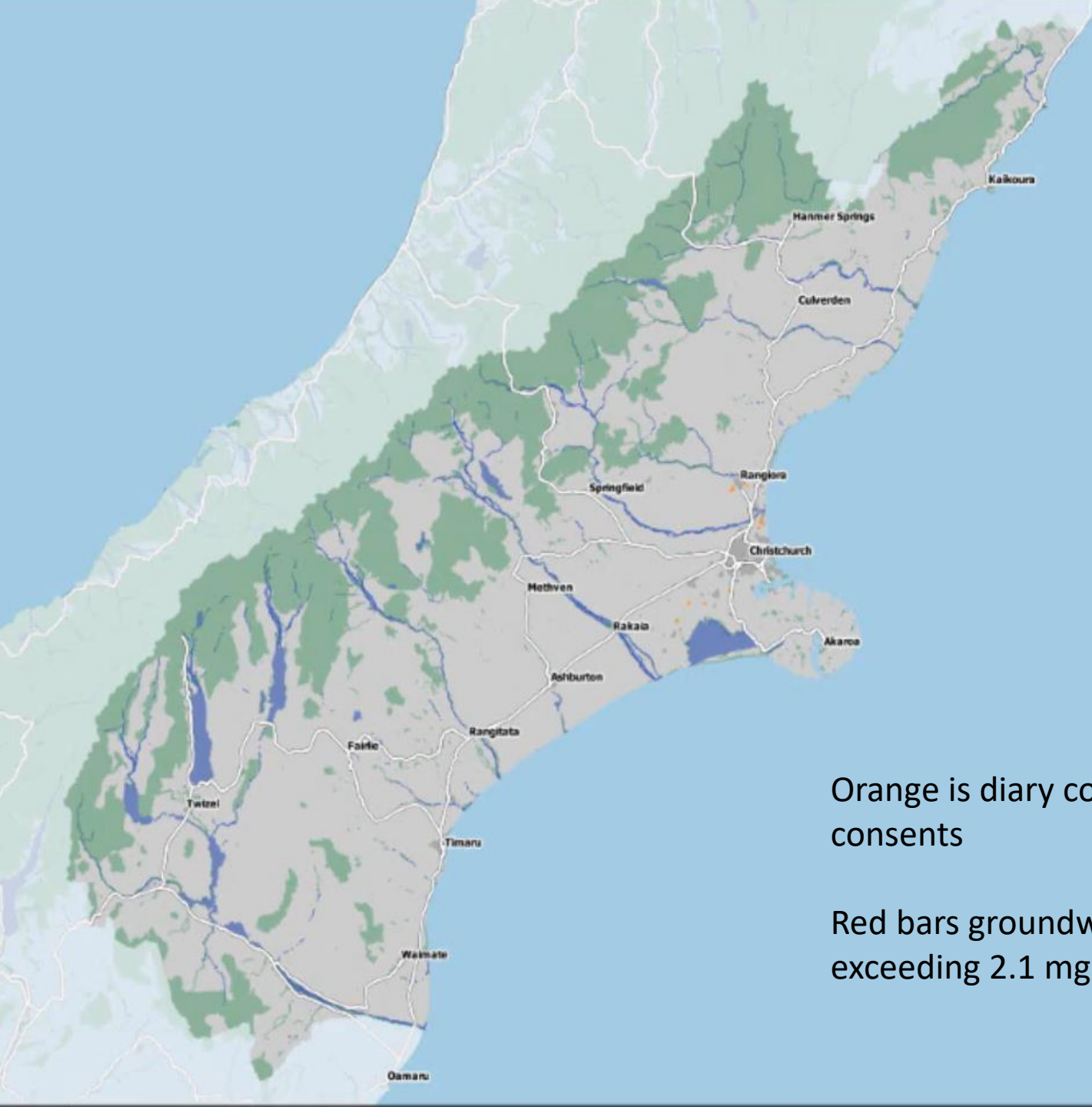


Consents for dairy conversion

Dairy production 60 fold increase from 6 mkg in 1984 to 385 mkg 2016

And the conversions need water lots of it

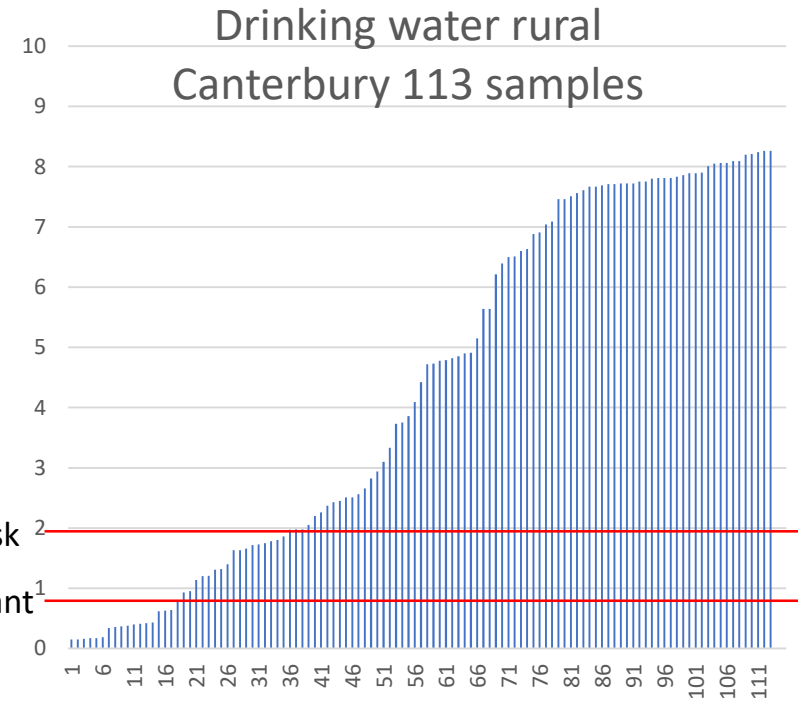
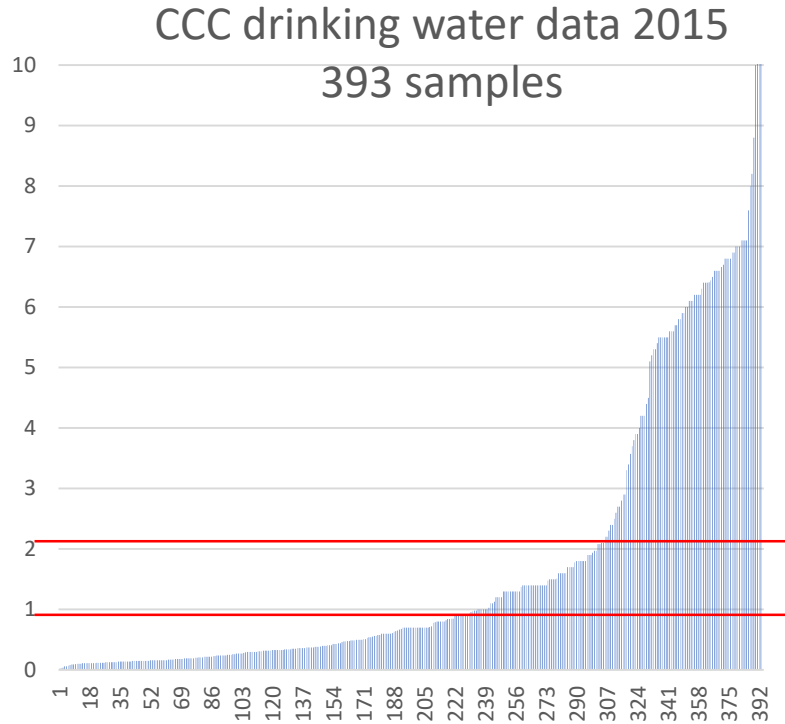
And the pivot irrigators meant removing the shelter belts in the region with the greatest evapotranspiration in NZ (322 mm/pa)



Orange is dairy conversion consents

Red bars groundwater samples exceeding 2.1 mg/l

# How safe in Canterbury drinking water?



Christchurch City and rural Canterbury drinking water and colo-rectal cancer trigger levels

# How safe in Canterbury drinking water?



## Report on a survey of New Zealand drinking-water supplies for arsenic and nitrate

October 2018

Authors:

Chris Nokes and Jacqui Ritchie

Region and threshold used	Drinking water supplies exceeding to 500 or more people	Absolute minimum number of people receiving
Canterbury above 2.1 mg/l NO <sub>3</sub> N	21	10,500
Canterbury above 0.87 mg/l NO <sub>3</sub> N	66	33,000

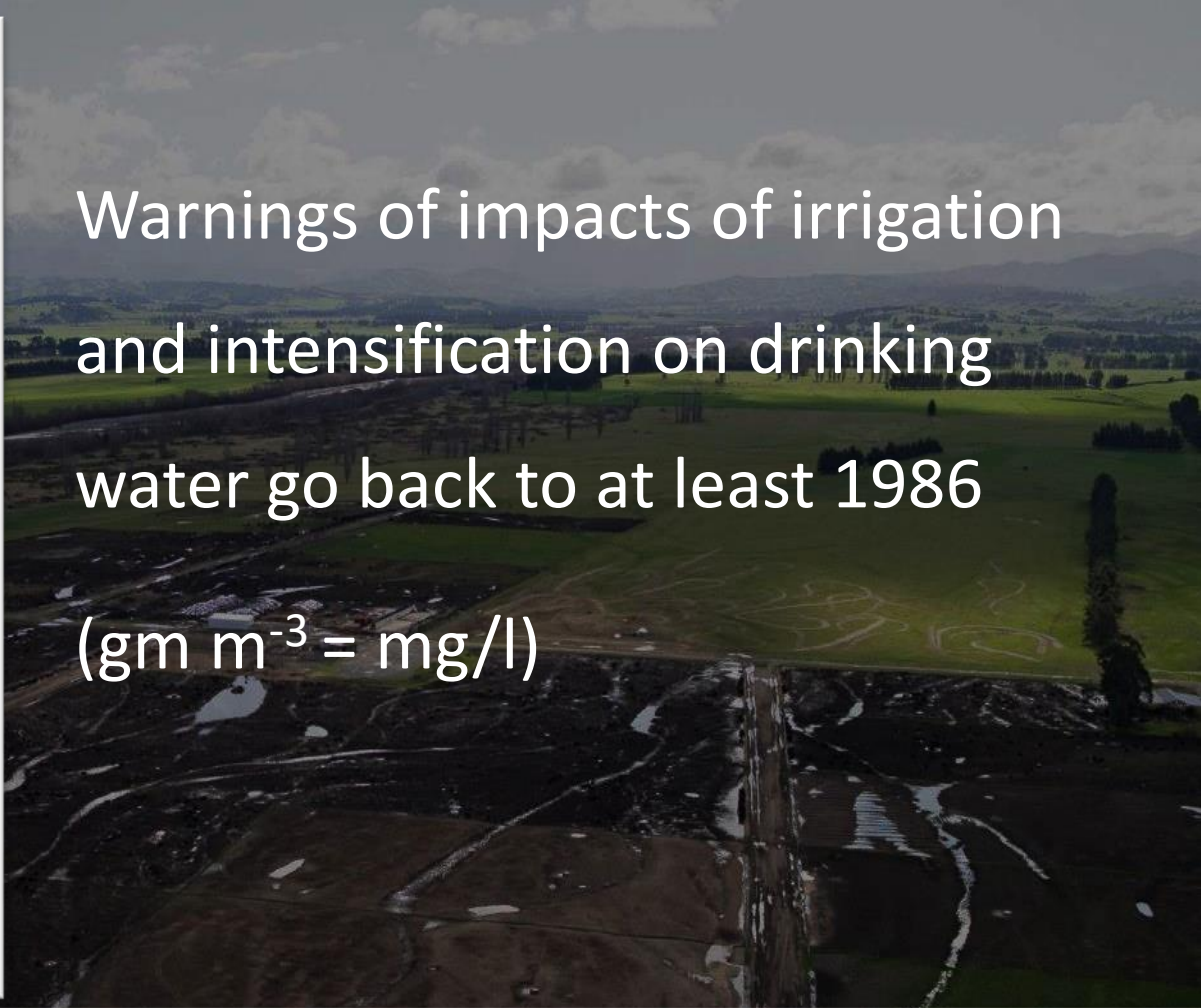
GROUND WATER RESOURCES  
BETWEEN THE RAKAIA AND  
ASHBURTON RIVERS

D.M. SCOTT and H.R. THORPE

PUBLICATION NO. 6 OF THE  
HYDROLOGY CENTRE  
CHRISTCHURCH

CHRISTCHURCH  
MARCH 1986

Publication no. 6 of the Hydrology Centre, Christchurch (1986)



Warnings of impacts of irrigation  
and intensification on drinking  
water go back to at least 1986  
( $\text{gm m}^{-3} = \text{mg/l}$ )

been no detectable effect on long-term piezometric levels. The present  
Ashburton-Lyndhurst Irrigation Scheme has a significant effect on ground  
water quality in some areas and further irrigation will probably raise  
nitrate-nitrogen concentrations to 15-20  $\text{g m}^{-3}$ . An alternative water  
supply for rural households may have to be considered.

# But dairy is the backbone of the economy isn't it?



## New Zealand Dairy Farming: Milking Our Environment for All Its Worth

Kyleisha J. Foote<sup>1</sup> · Michael K. Joy<sup>1</sup> · Russell G. Death<sup>1</sup>

### 'Back of the envelope' insights - 2014

	Forest	Dairy	
<b>LAND</b>	Hectares	28,000	26,600 grazable
	Land value	10,000 \$/ha	36,100 \$/ha
	Yield/unit	678 m <sup>3</sup> /ha	950 kg milk solids/ha
	Price range	89 to 102 \$/m <sup>3</sup>	5 to 9 \$/kg milk solids
<b>PROFIT</b>	Surplus range	22 to 32 million \$/yr	-6 to 96 million \$/yr
	Probabilities of loss	0 %	13 %
	Manufactured Product	67,550 t pulp	38 million kg whole milk
		275,268 green timber m <sup>3</sup>	
	10-year avg. export price	737 \$/t pulp	7 \$/kg milk solids
		404 \$/m <sup>3</sup> green timber	5 \$/kg whole milk
	Manufactured exports	161 million \$/yr	179 million \$/yr
	Employment: Upstream	84 emp/forest/yr	415 emp/farm/yr
	Downstream	280 emp/mill/yr	175 emp/plant/yr
	Phosphorus	0.05 kg/ha/yr	1 kg/ha/yr
	Nitrogen discharge	3 kg/ha/yr	54 kg/ha/yr
	Nitrogen price	400 \$/kg	400 \$/kg
	Carbon emitted/stored	11 t CO <sub>2</sub> e/ha/yr seq	10 t CO <sub>2</sub> e/ha/yr emitted
	Carbon price	7 \$/t CO <sub>2</sub> e	7 \$/t CO <sub>2</sub> e
<b>EXTERN</b>	Externality	31 million \$/yr	- 18 million \$/yr

We (taxpayers) are paying/paid dairy farmers ~ \$130 million not to farm, in an attempt to reduce nitrogen entering lake Taupo and Rotorua ...

what about all the other lakes and rivers?

# But dairy is the backbone of the economy isn't it



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### Getting the balance right

The effect of water quality proposals on the New Zealand economy

NZIER report to the New Zealand Fish and Game Council, Forest and Bird and Greenpeace  
September 2019

30 million kg N leached in Canterbury annually multiply that by \$400/kg = \$12 billion

So by allowing them to pollute that much is equivalent to a \$12 billion subsidy

## Selwyn Te Waihora zone

Memorandum on the implications of meeting the National Policy Statement for Freshwater Management objectives for lake environments in Te Waihora

June 2017

Another Canterbury example of subsidising dairy by allowing externalities

Modelling done for ECAN on the cost to meet NPS-FM Lake minimum TLI requirements

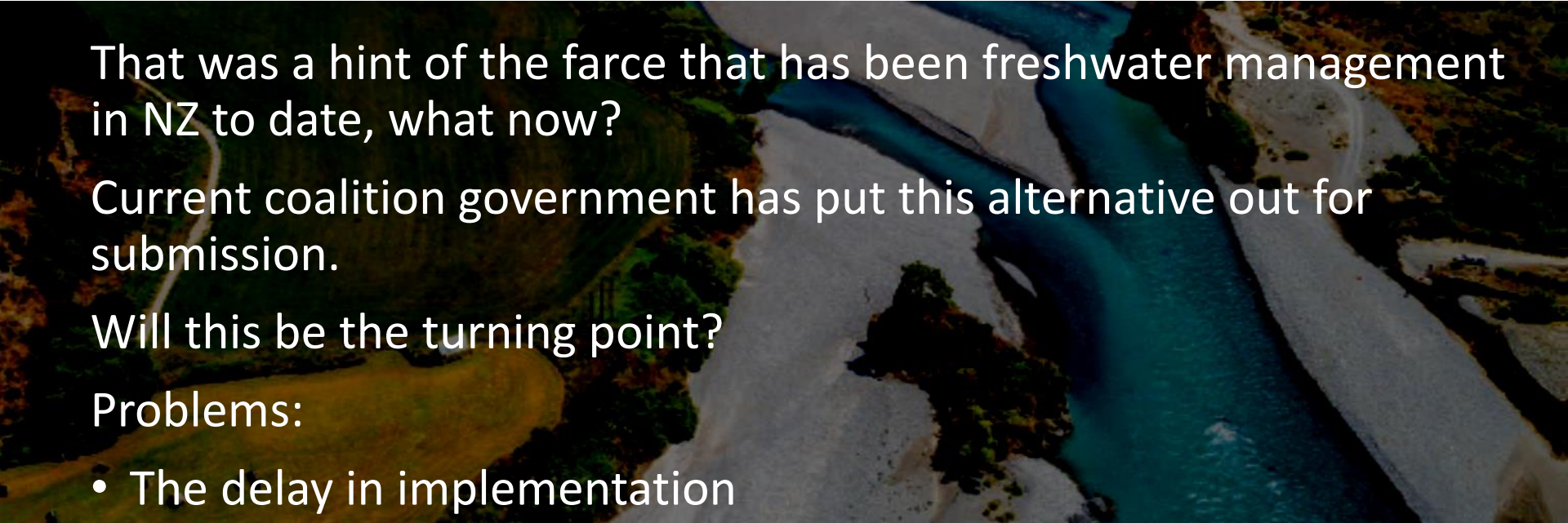
- \$300 million in loss of revenue (dairy)
- Or a constructed wetland to soak some of the nutrients up \$380 million
- Outcome – too expensive do nothing

Released under the Official Information Act



The advice from the science & technical advisory group (STAG) to government (Science/ecology based assessment vs. managerial assessment of the past)

- Water quality & quantity, habitat, aquatic life and ecological processes.
1. Continuous DO rivers and lakes + Ecosystem metabolism
  2. Nitrate and DRP to meet periphyton limits
  3. Bioassessment - Fish IBI, Invertebrate metrics
  4. Lake SPI Aquatic plants
  5. River habitat - Deposited sediment
  6. Nutrients DIN (bottom line 1mg/l cf 6.9 under existing NPS)
  7. Wetland extent - % of original & condition index



That was a hint of the farce that has been freshwater management in NZ to date, what now?

Current coalition government has put this alternative out for submission.

Will this be the turning point?

Problems:

- The delay in implementation
- Will councils even apply it?
- The industry attacks already - 'fart tax' tactics?
- Will we continue with corporate welfare?

Essential  
Freshwater

**Healthy Water, Fairly Allocated**

## Solutions:

1. Honest environmental reporting (not central or local govt.)
2. Measure meaningful things (externalities not GDP)
3. Match landuse to environment not the other way around
4. Biological/regenerative farming – maximising soil health and minimising fertiliser use reinstate - nutrient cycling.
5. Accept we are in overshoot and that issues like climate change and everything I talked about are symptoms so don't try to fix them individually
6. Trust the science, don't let vested interests profit from destroying what belongs to us all

# Mountains to Sea: Solving New Zealand's Freshwater Crisis

Edited by Mike Joy

*It strikes me with great clarity that if you look at the problems in isolation they each seem intractable; but when you grasp that there could be one single solution, then suddenly there is a glimpse of light at the end of the tunnel.*

The state of New Zealand's freshwater has become a pressing public issue in recent years. From across the political spectrum, concern is growing about the pollution of New Zealand's rivers and streams. We all know they need fixing. But how do we do it?

In *Mountains to Sea*, leading ecologist Mike Joy teams up with thinkers from all walks of life to consider how we can solve New Zealand's freshwater crisis. The book covers a wide range of topics, including food production, public health, economics and Māori narratives of water. *Mountains to Sea* offers new perspectives on this urgent problem.

**Contributors:** Mike Joy, Tina Ngata, Nick D. Kim, Vanessa Hammond, Paul Tapsell and Alison Dewes, Peter Fraser, Kyleisha Foote, Catherine Knight, Steven Carden and Phil McKenzie, Chris Perley



Paperback \$14.99 | ebook \$4.99 | ISBN 9781988545431  
Publication: November 2018 | 200 pages

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Polluted Inheritance  
New Zealand's  
Freshwater Crisis

MIKE JOY

'NEW ZEALAND NOW HAS THE HIGHEST  
PROPORTION OF THREATENED AND  
AT-RISK SPECIES IN THE WORLD'

# POLICY Quarterly

Volume 15 – Issue 3 – August 2019

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CANTERBURY FRESH WATER

## The environmental and human health impacts of dairy intensification: A CASE STUDY – CANTERBURY

**Mike Joy**, Senior Researcher at the Institute for Governance and Policy Studies, Victoria University of Wellington, argues that New Zealand is in the midst of a freshwater crisis brought on by dairy intensification. Nowhere is that better illustrated than in Canterbury, whose water quality is increasingly threatened by nitrate contamination.

Thanks to:

Victoria  
University  
IGPS,  
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activist friends  
students &  
colleagues all  
over New  
Zealand

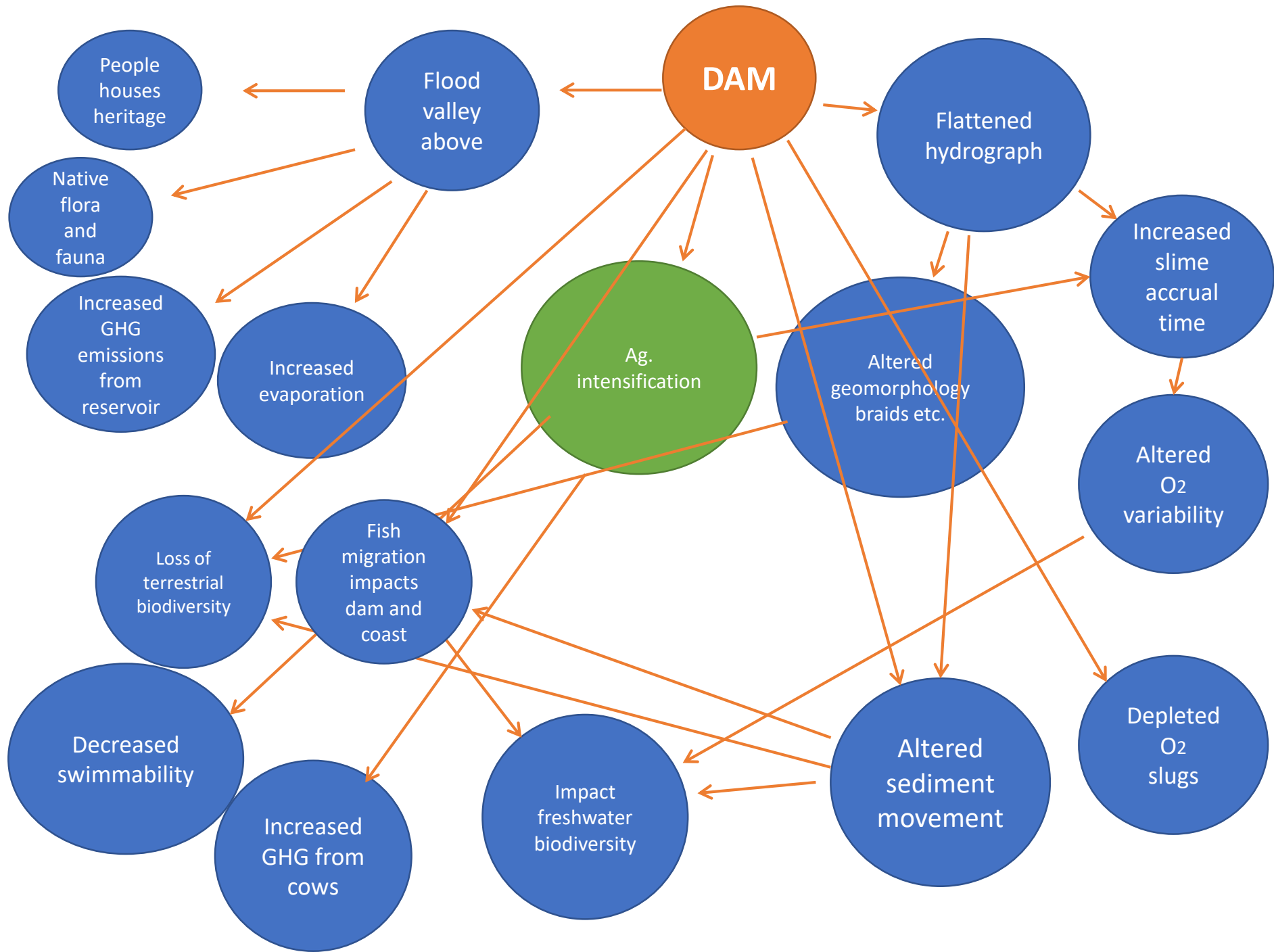
[www.waterqualitynz.info](http://www.waterqualitynz.info)

Capital thinking. Globally minded.

# Human edible protein per hectare

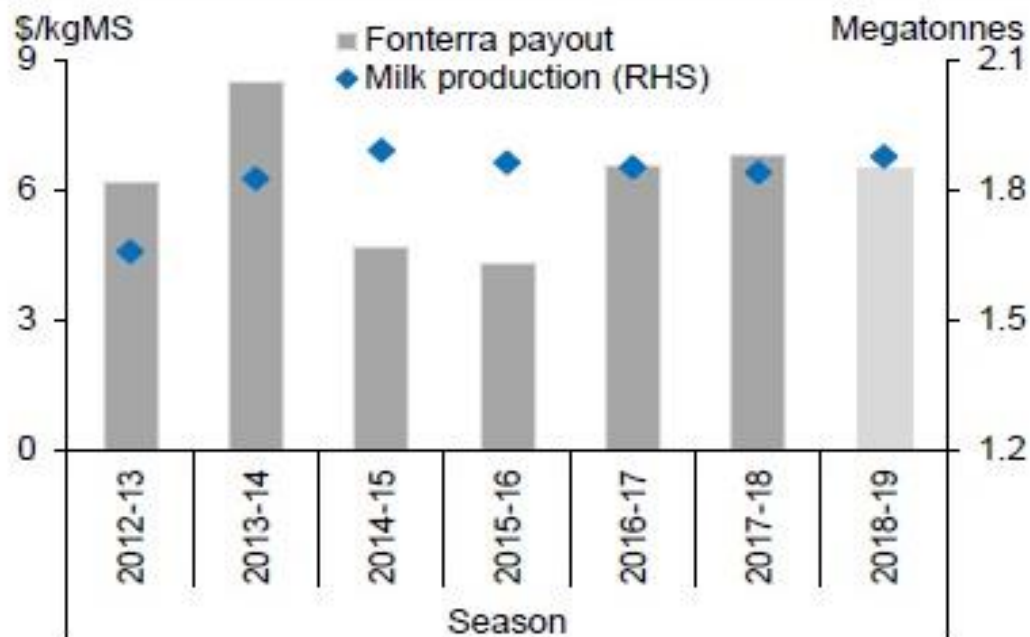
Foods	Kg Usable Protein / ha	Water use /kg protein
Soybeans	833	
Faba beans	1295	4,500
Wheat	726	22,500
Milk	707	29,400
Beef	14	





debts. Around 35 percent of dairy farm debt is to farms that have more than \$35 of debt per kilogram of milk solids (kgMS) produced annually. On average, these highly indebted farms require a price of \$6.20 per kgMS just to break even. Fonterra currently forecasts a price range of \$6.30 to \$6.40 for this season.

**Figure 2.9**  
Dairy  
prices and  
production



Source: Dairy Companies Association of New Zealand, Fonterra, RBNZ estimates.

Note: Payout figures include dividends. The 2018-19 season payout is based on Fonterra's latest forecasts, and the milk production figure is based on RBNZ estimates.

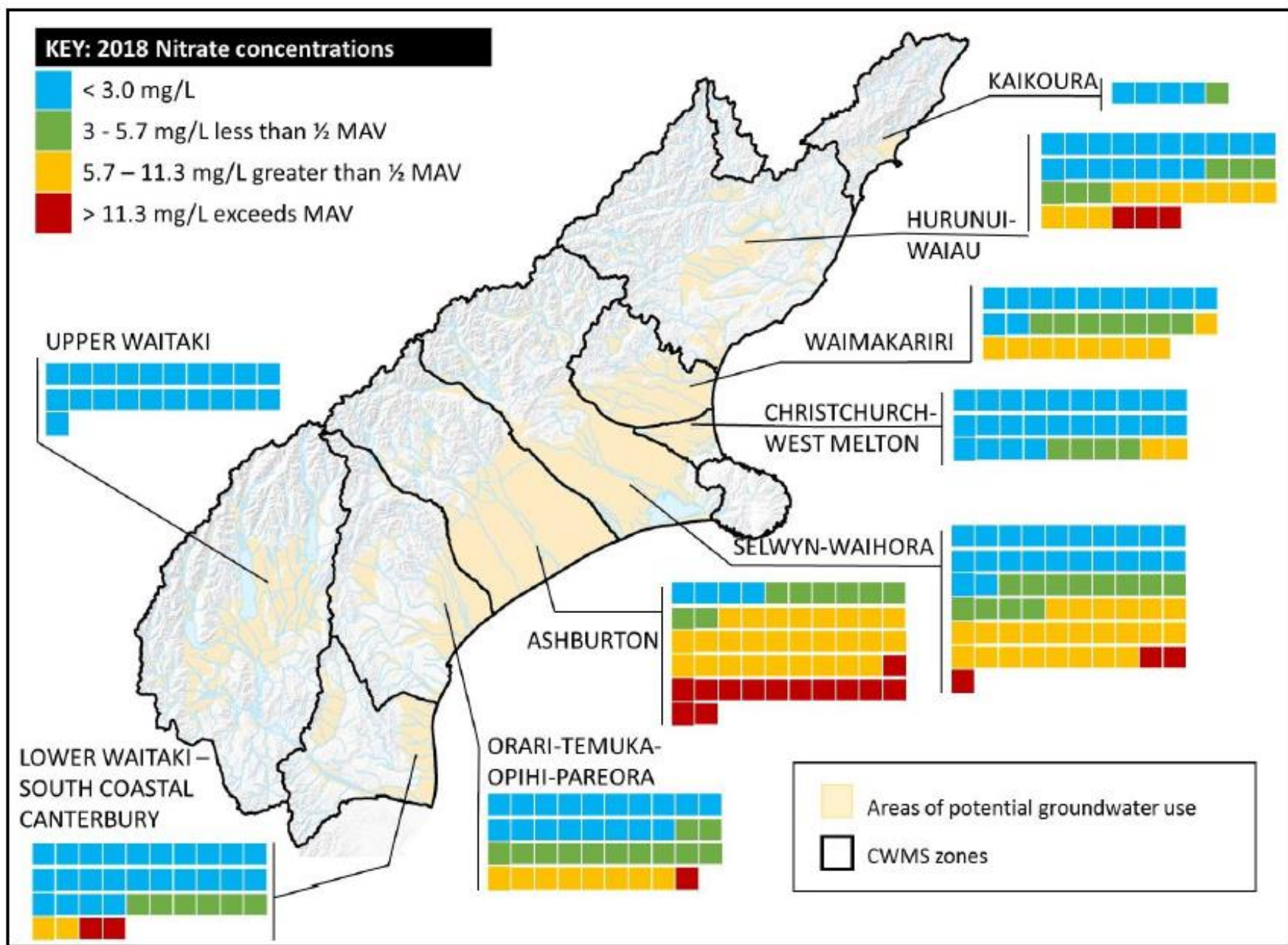
- South Island dairy cattle have increased from 0.6 million in 1994 to 2.6 million in 2017. Most of this increase occurred in Canterbury (1.1 million), Southland (0.6 million), and Otago (0.3 million). Over the same period beef cattle numbers in the South Island have stayed relatively stable (just above 1.0 million). <https://www.stats.govt.nz/indicators/livestock-numbers>
- The area of irrigated land in Canterbury almost doubling (241,000ha to 478,000ha). Canterbury has the greatest area of irrigated agricultural land in the country (478,000ha, or 64 percent of irrigated land), followed by Otago (94,000ha, or 13 percent). <https://www.stats.govt.nz/indicators/irrigated-land>



- “Ngai Tahu supports water being made available to provide security of supply for landowners but is concerned at the possible conversion to dairying. Almost without exception, the conversion over recent years of dry land farms to dairying has brought with it a host of adverse environmental effects and has resulted in the significant degradation in the quality of our rivers, lakes, streams and wetlands. This has impacted seriously on the cultural health of waterways and has resulted in the further loss of access by tangata whenua to mahinga kai sites and resources.
- <http://mackenzieguardians.co.nz/2010/01/ngai-tahu-predicts-catastrophe-from-dairying/>

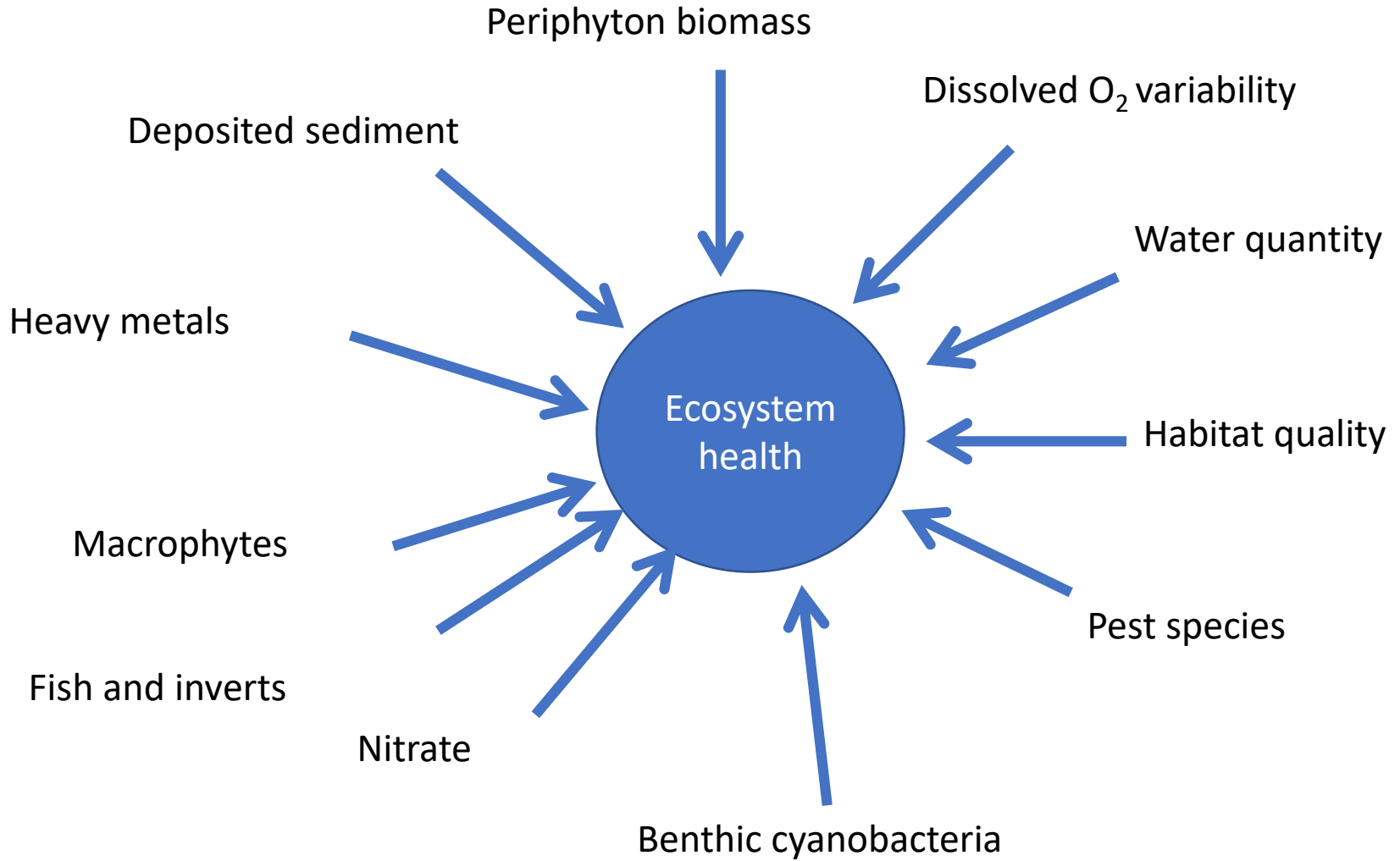
- Across the region's low plains, a total of 11,630 ha of formerly undeveloped or forested river margin have been converted to intensive agricultural use between 1990 and 2012, an average of about 530 ha per year.
- <https://braid.org.nz/wp-content/uploads/2016/06/LandusechangeonthemarginsoflowlandCanterburybraidedrivers19902012.pdf>





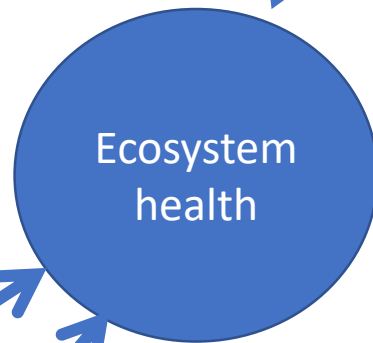
**Figure 4: Summary of nitrate concentrations sampled in the 2018 annual survey for each CWMS zone**

# Crucial measures of ecosystem health



# What is in NOF/NPS

~~Periphyton biomass~~ but crucial 17% exemption



~~Fish and inverts~~  
MCI set at severely polluted

~~Nitrate toxicity only~~

That was the trends, now what about Canterbury groundwater status?

Nitrate nitrogen (NO3N) mg/l	ECAN groundwater monitoring data	Percentage of 320 ECAN sites exceeding thresholds
0.87	Significant increase in chance of colorectal cancer	72%
1.6	Probably indicative of anthropogenic effects	62%
1.7	ANZECC guidelines for aquatic species protection	62%
2.1	15% increase in risk of colorectal cancer	59%
2.5	Indication of high intensity land-use impact	56%