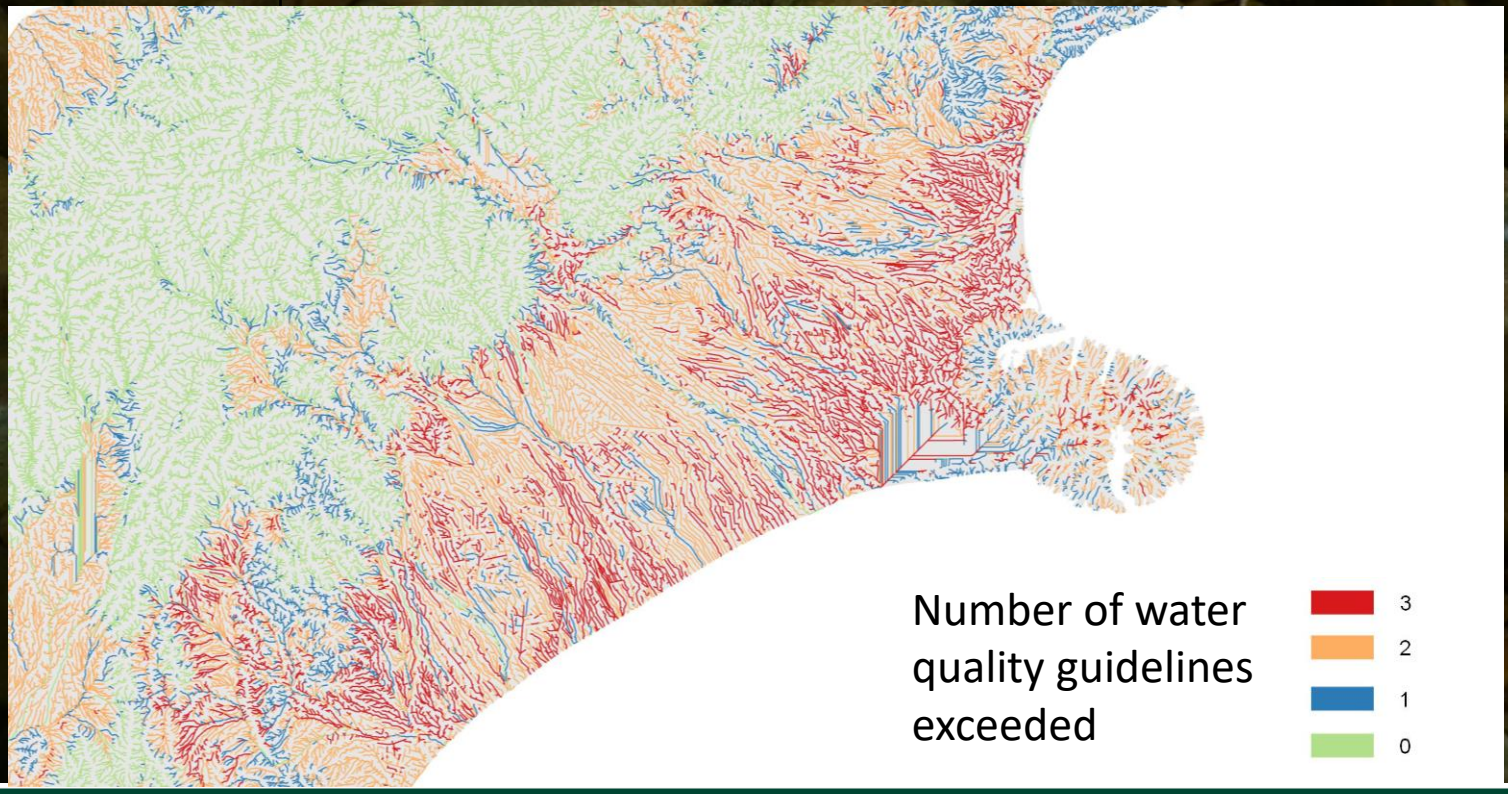
How we fail to protect freshwater in New Zealand, a Canterbury case-study

Mike Joy; Institute for Government and Policy Studies Victoria University



Talk outline

- Loading the plane – have a zone committee to decide? anyway its only the environment …
- The politicisation of freshwater science in New Zealand
- The consequences for the environment the irrigation and dairy bonanza, environmental on human health, economy and tourism
- A critique of ECAN, MfE, MPI and MoH environmental reporting

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 popul swimming holes

NEW ZEALAND | Health

12:00 pm on 11 January 2019

Health warning as second lake succumbs to scum

Wednesday, 9 January 2019

Call for action over E coli in lake

Algal bloom brings health warning for Rotorua's Lake ro and Lake Rotoehu

211 2

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

By Reuters

ic-resistant bacteria discovered in

018

Health Warning: Unsafe Recreational Water Quality at Sandy Bay

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

New Zealanders most concerned about pollution of lakes and rivers, new poll finds

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

VIRGINIA FALLON · 10:03, Oct 26 2018

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

g owners and swimme atch for toxic algae in ri

Boyack · 15:11, Jan 11 2019

Popular Auckland beaches too polluted to swim in

27/12/2018 Newshub reporter

Toxic algae warning in Tasman

Skara Bohny · 12:30, Jan 13 2019

Toxic algae appearing in Marlborough streams

11:20, Jan 05 2019

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

Toxic algae and

TOXIC ALGAE

Video will play in 2 seconds Stop

People swim at popular Whanganui lake despite warning signs

31 Dec, 2018 9:00am

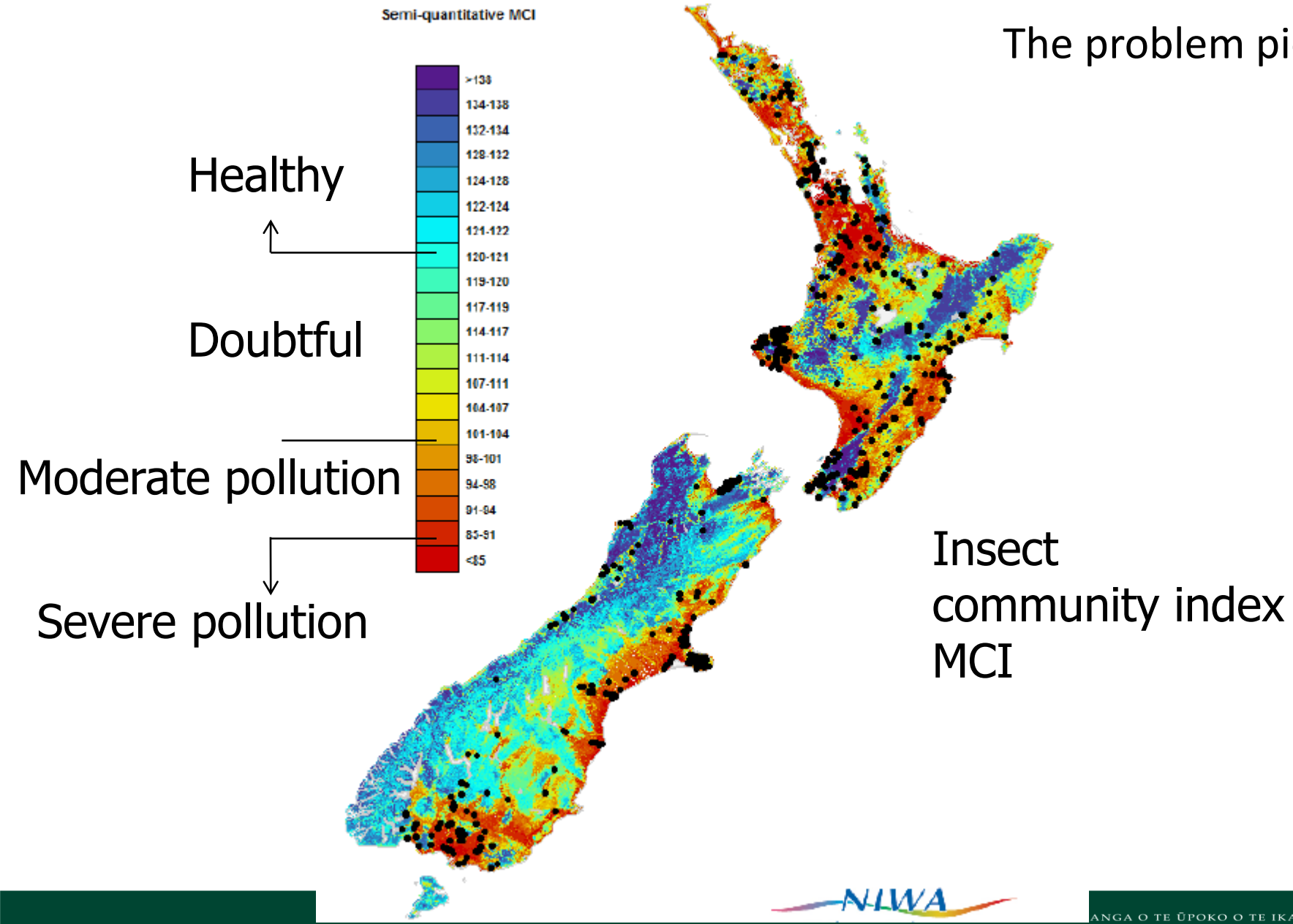
New Zealand summer December 2018/January 2019

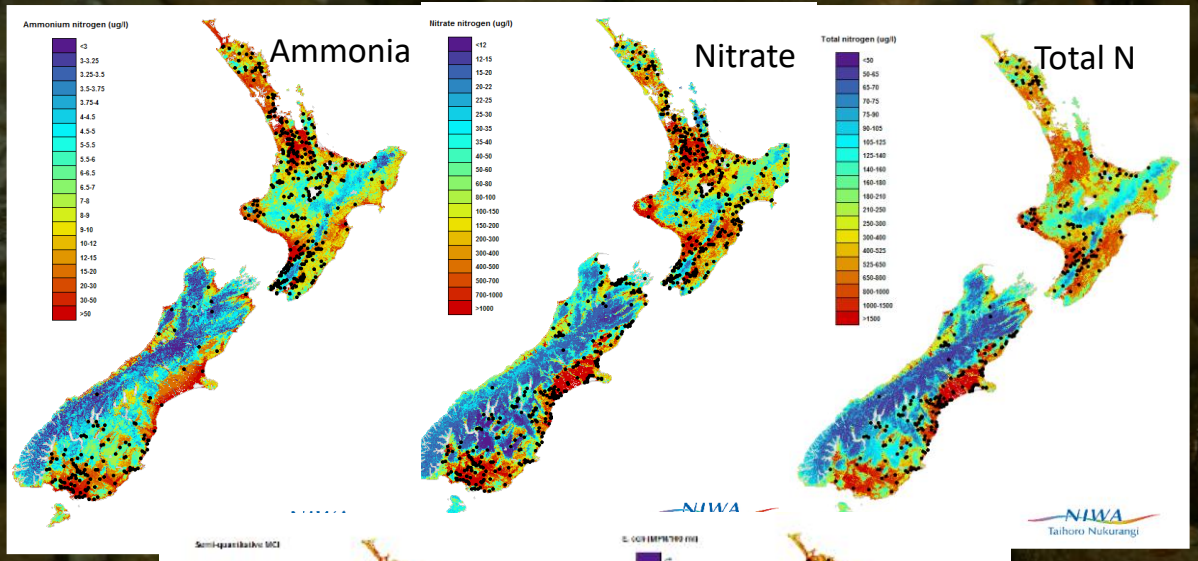
pital thinking. Globally minded.

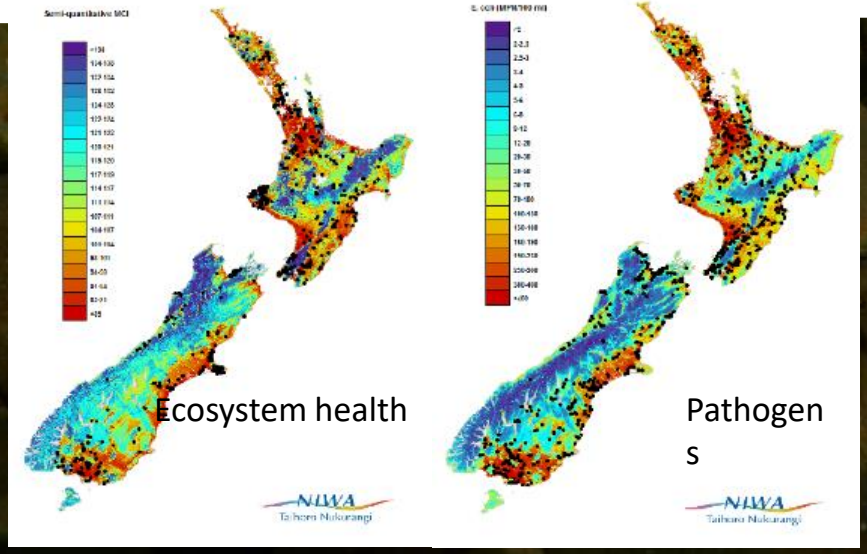
TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI

VICTORIA UNIVERSITY OF WELLINGTON

The problem picture







The state of freshwater in New Zealand

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

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—

ontaminant includes any substance (including gases, odorous compounds, liquids, olids, and micro-organisms) or energy (excluding noise) or heat, that either by itself or in ombination 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 nvironment arising from an activity carried on by or on behalf of the person, whether o

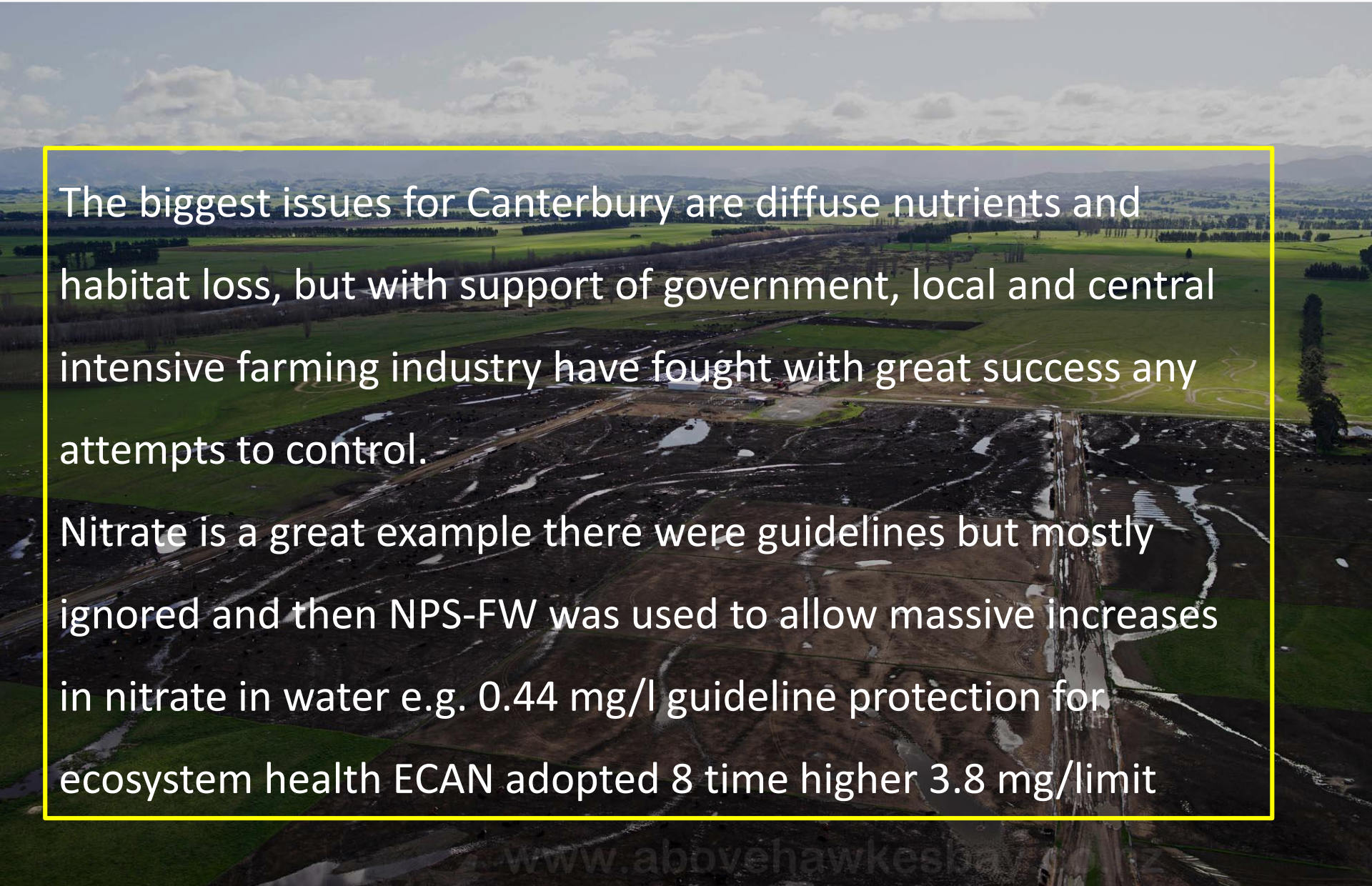
local government failure to enforce from 1990 – 2014 then Central Govt. weakening of limits to support more agricultural intensification

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)

Our freshwater crisis – the causes



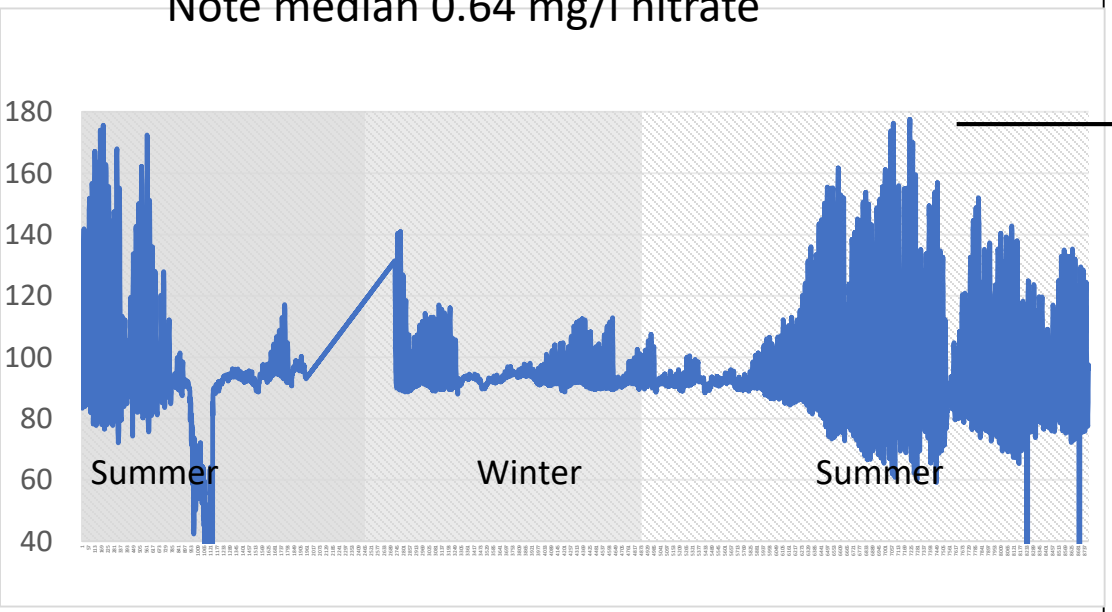
The biggest issues for Canterbury are diffuse nutrients and habitat loss, but with support of government, local and central intensive farming industry have fought with great success any attempts to control.

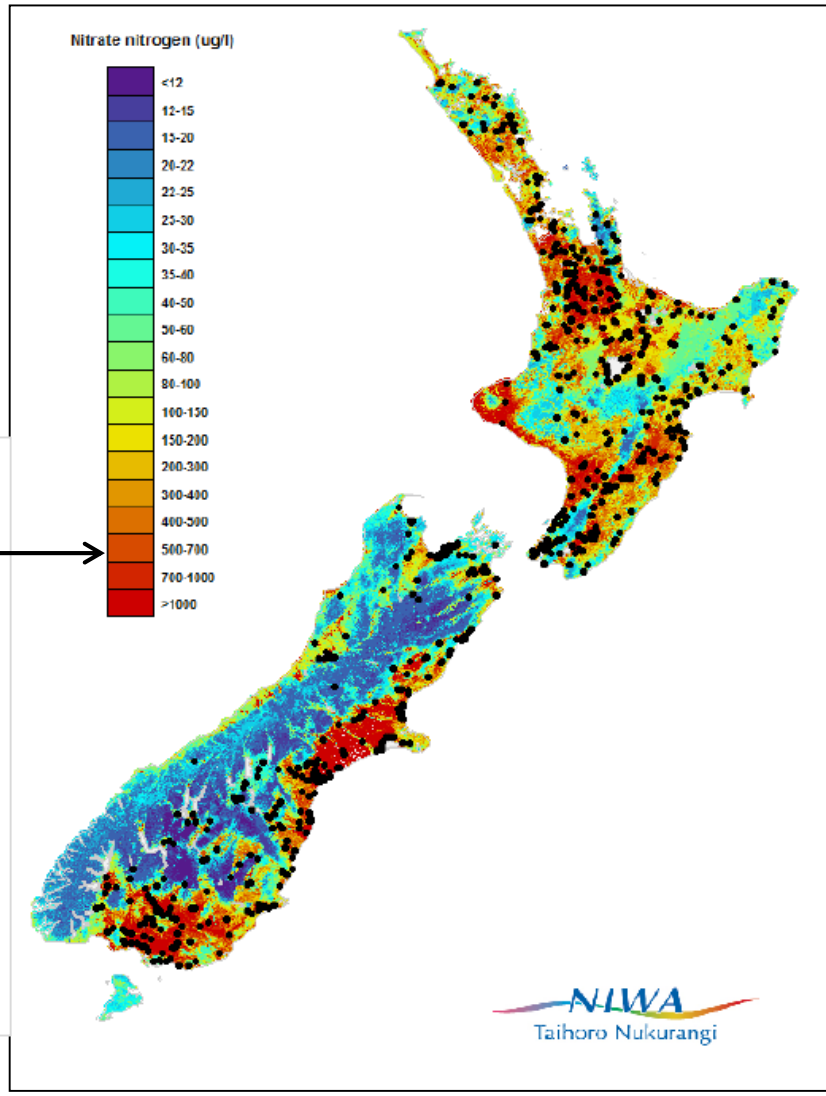
Nitrate is a great example there were guidelines but mostly ignored and then NPS-FW was used to allow massive increases in nitrate in water e.g. 0.44 mg/l guideline protection for ecosystem health ECAN adopted 8 time higher 3.8 mg/limit

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

Excess nitrate → periphyton growth and more → O_2 variability → O_2 extremes

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





NO3-N mg/l

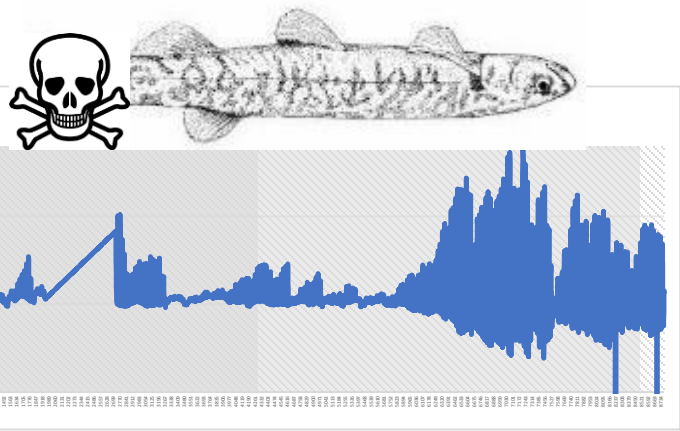
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0

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

River water

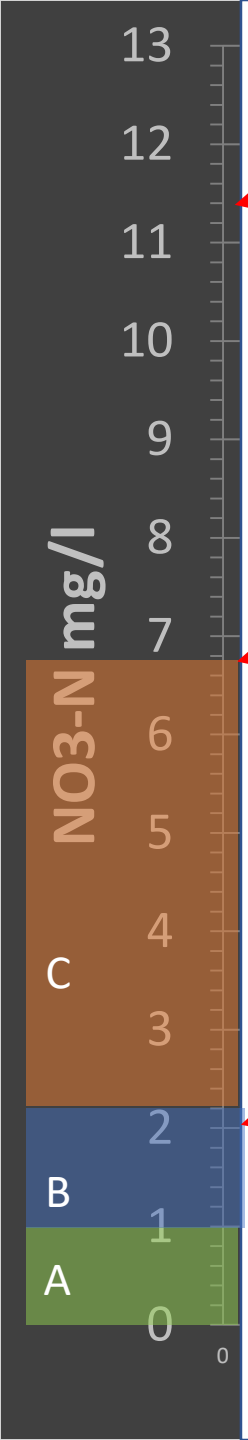
NPS-FM rivers bottom line aquatic nitrate toxicity 6.9 mg/l

CWMS limit half nitrate toxicity 3.8 mg/l



Median value Hopelands Road site 0.64 mg/l

ANZECC guideline limit to protect river ecosystems 0.44



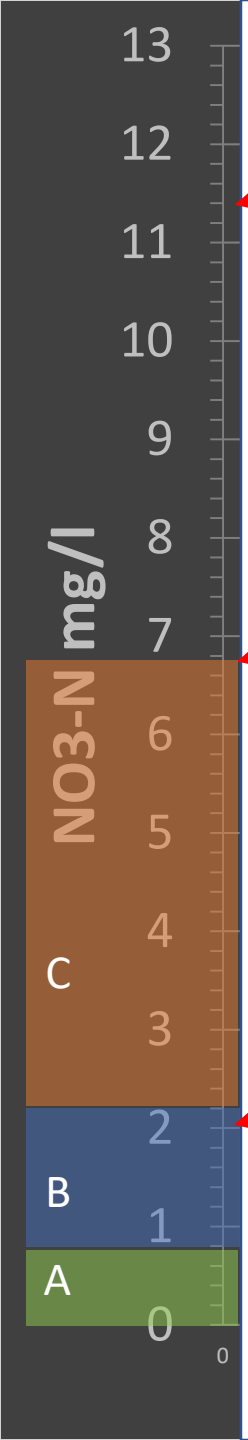
Drinking water MAV 11.3 mg/l from WHO blue baby syndrome

River water 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



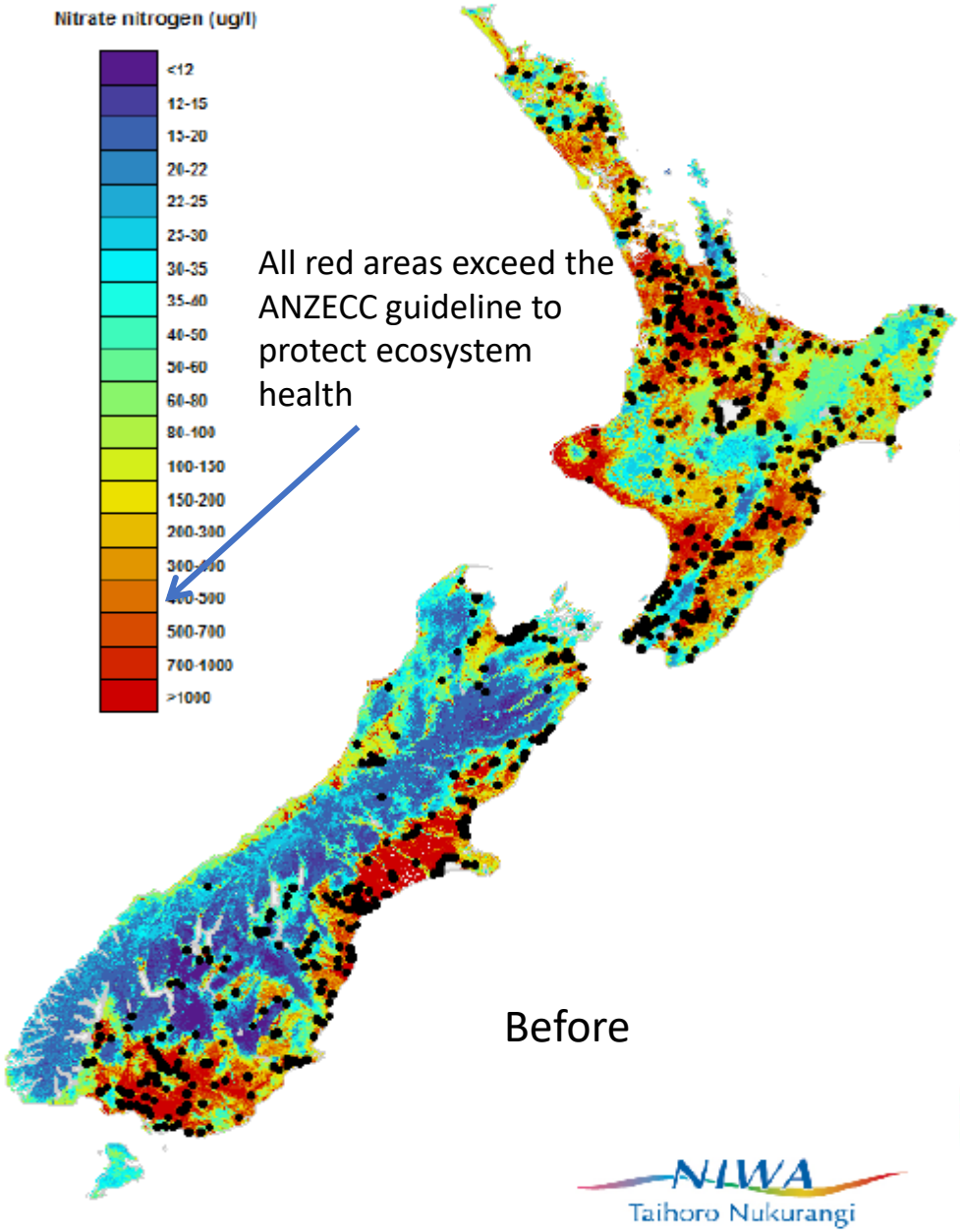
Drinking water MAV 11.3 mg/l from WHO blue baby syndrome

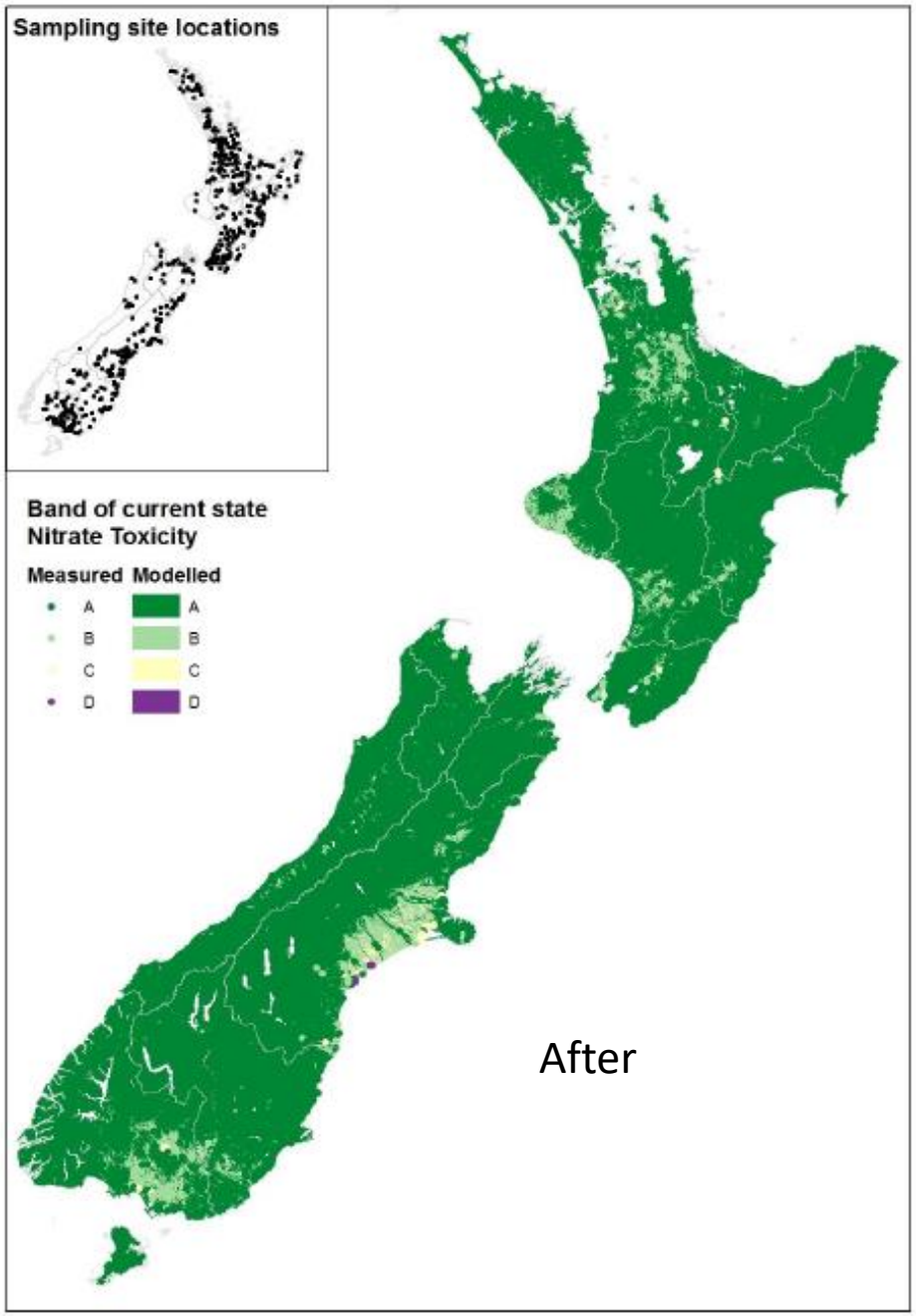
River water government response

NPS-FM rivers bottom line Nitrate toxicity 6.9 mg/l

The Yangtze & Mississippi rivers

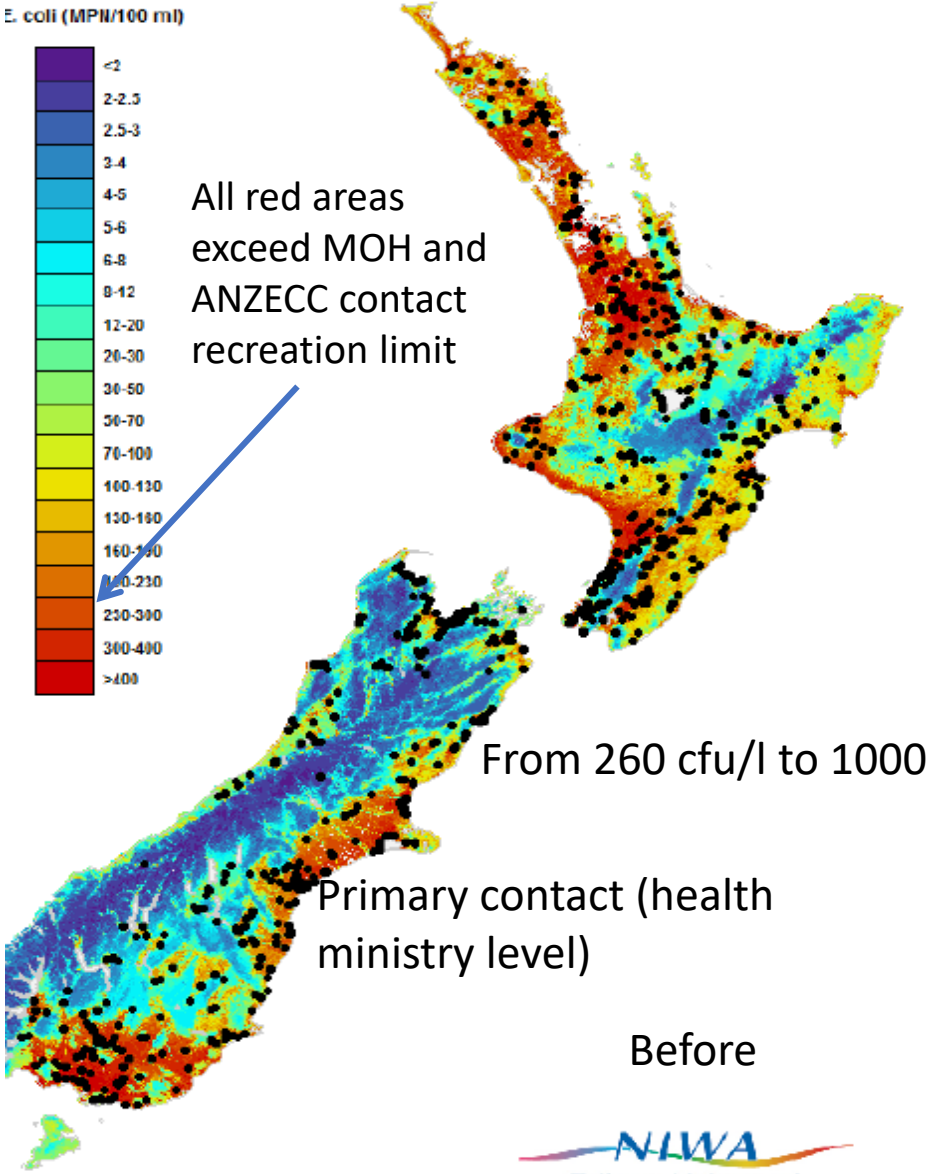
“A fresh start for freshwater” NPS objectives 2014: (making the problem disappear)





NIWA
Taihoro Nukurangi

“A fresh start for freshwater” NPS objectives 2014: (making the problem disappear)

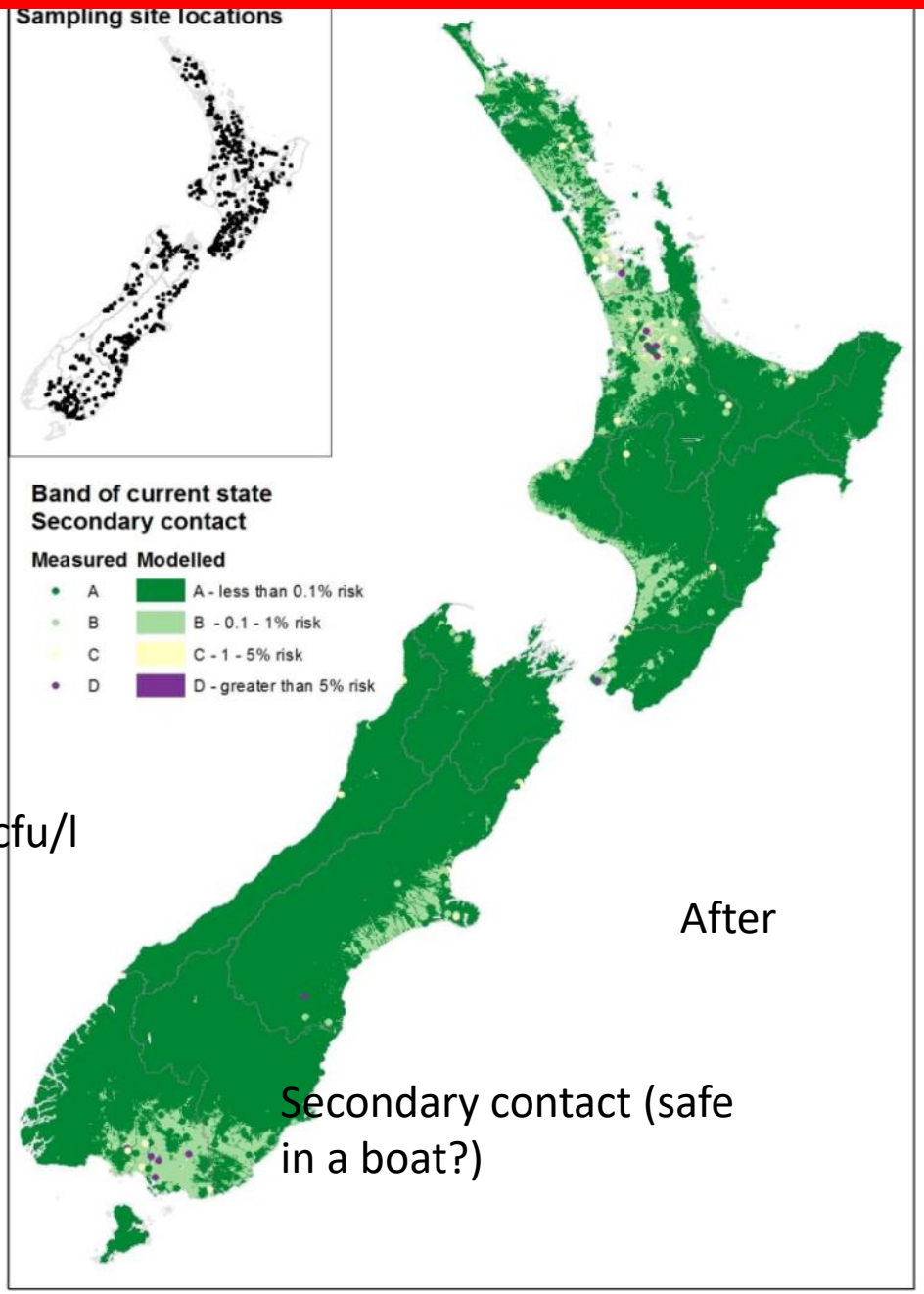


All red areas exceed MOH and ANZECC contact recreation limit

From 260 cfu/l to 1000 cfu/l

Primary contact (health ministry level)

Before



After

Secondary contact (safe in a boat?)

NIWA
Taihoro Nukurangi

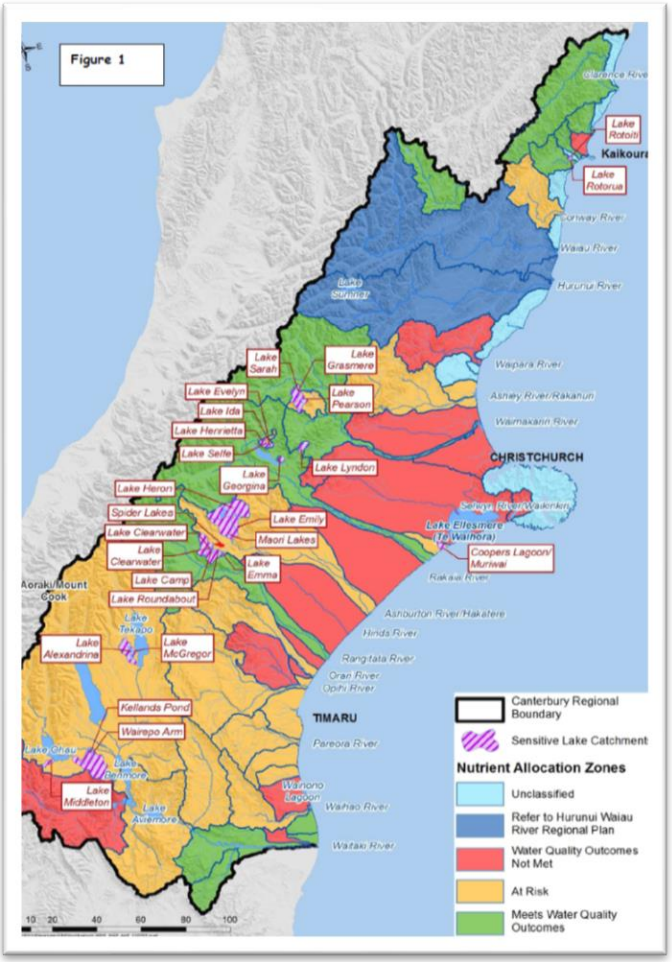
Another example of how water management is about politics/spin not science

80% swimmable by 2030 & 90% swimmable by 2040

BUT:

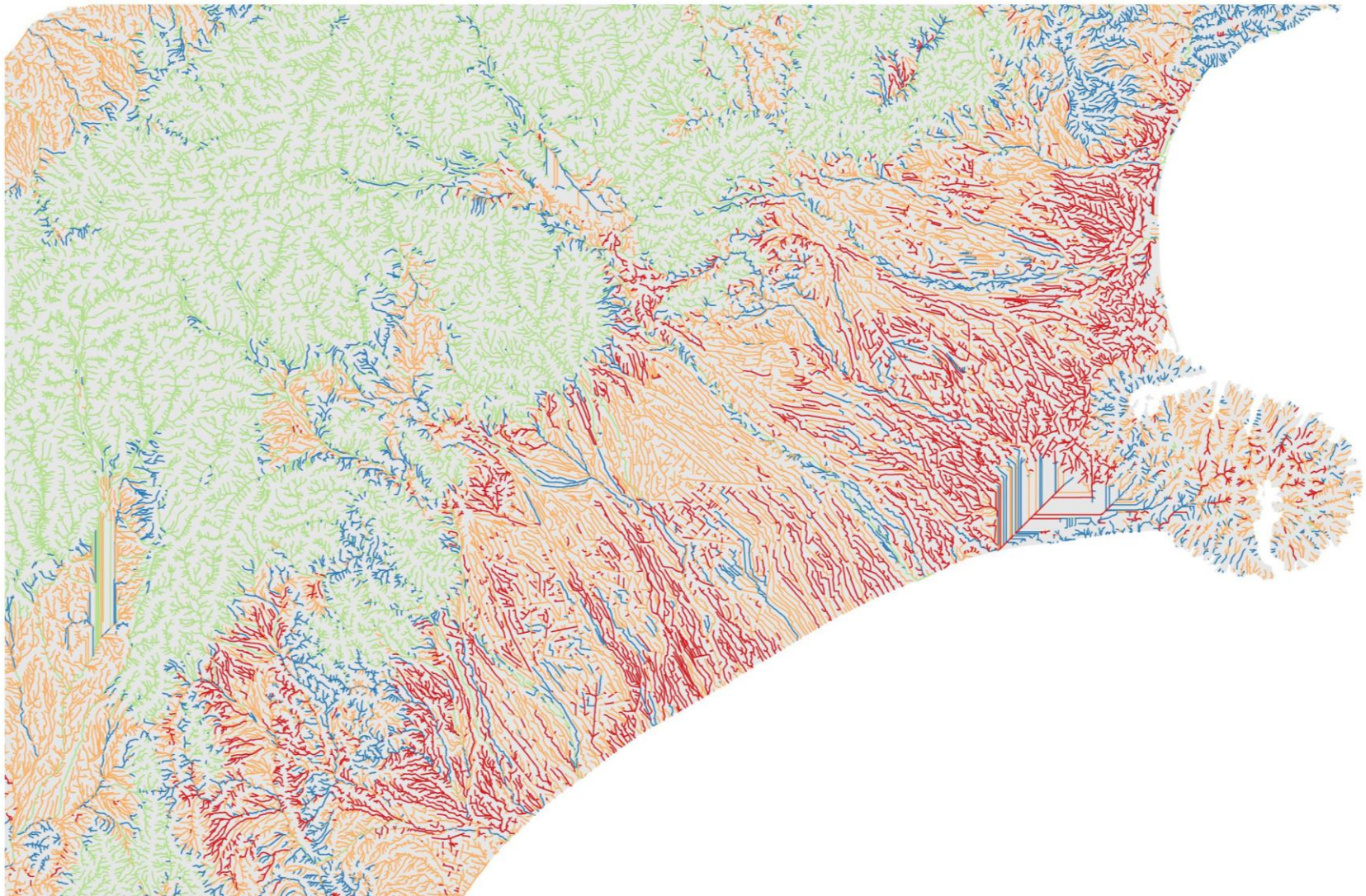
1. Only applies to lakes > 1.5km diameter (25% of lakes)
2. Only applies to >4th order waterways and that is ~12% of length if NZ waterways, 70% of them already swimmable so goal is actually 20% of 12 %
3. Limits shifted of 76 NWRQN sites number of sites swimmable under original NPS 42%, under Clean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

Canterbury case study

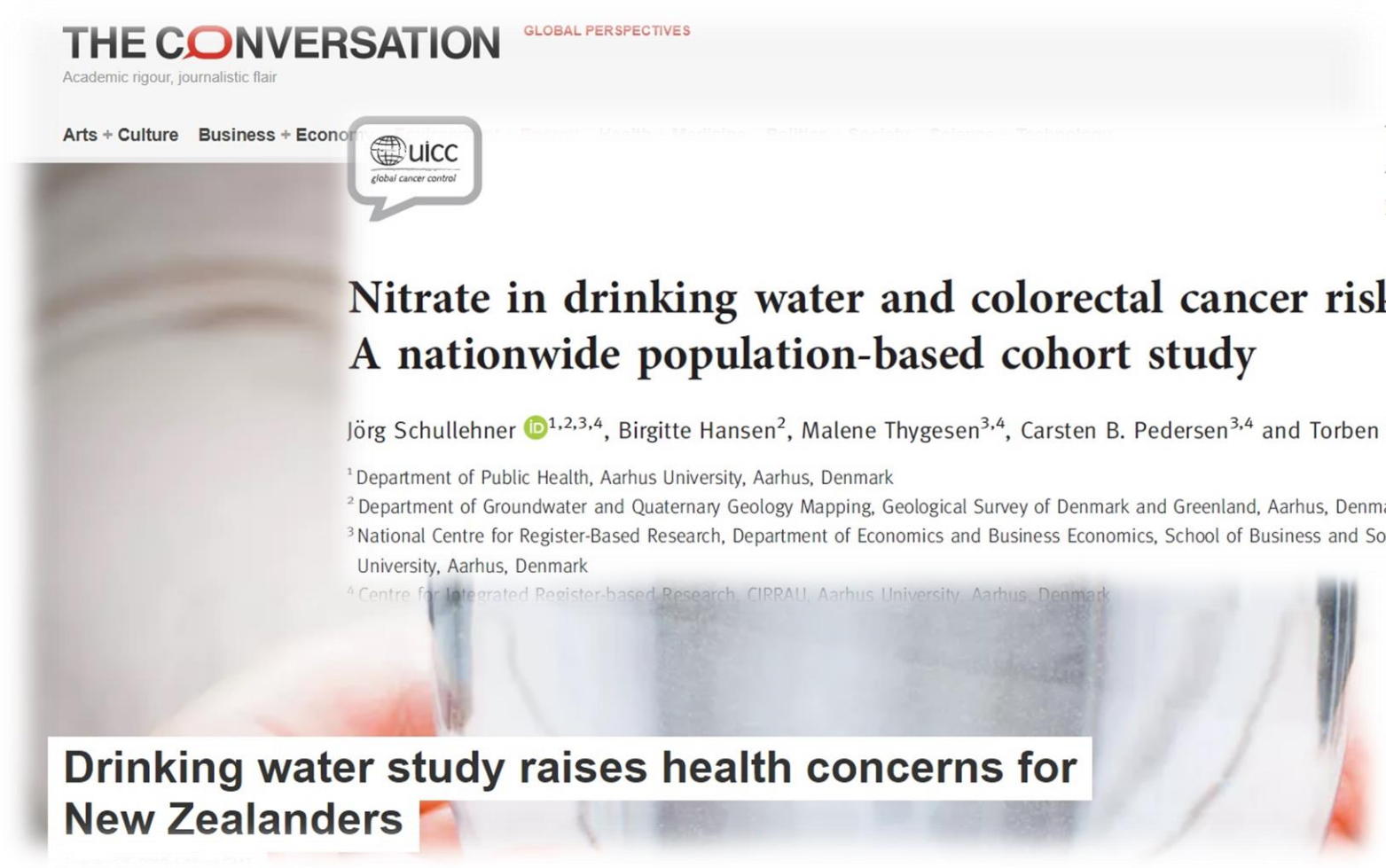


1. Regional Plan Policy: Inequity of grand parenting.
2. Declining Water Quality: Nitrate load upward, Aquifers, Spring fed streams
3. Wrong Limits 3.8 mg/l
4. Human disease: high rates zoonotic disease (via water?)
5. Biodiversity Loss waterways and terrestrial
6. Over reliance on Models. Overseer etc.
7. Legal: Drinking Water Degradation
8. Fair representation: Zone Meetings, GMPs and FEPs….
9. Ethics: Worsening Water Quality in just 10 years.
10. Debt Burden: Land values anchored to polluting systems

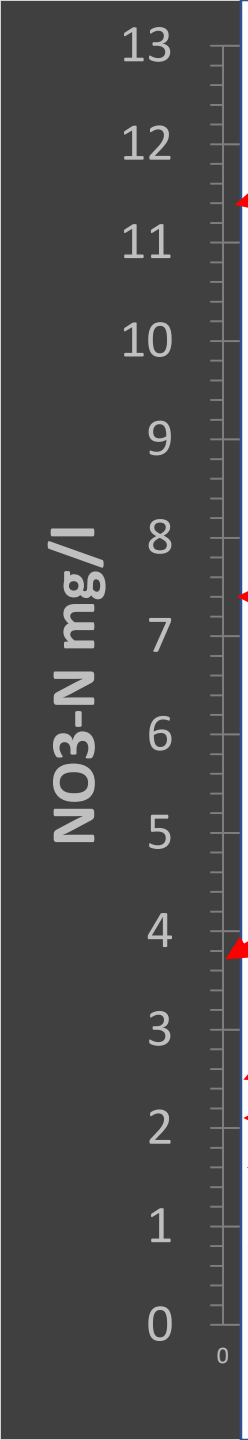
River Water Quality Modelled State 2013-2017 - Total number of factors not meeting ANZG standards for Total Nitrogen, Total Phosphorus, and E. coli



The consequences of allowing nitrate in water to increase



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



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

Groundwater

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 NO3-N for indication of high intensity land-use impact

The threshold groundwater value 2.1 mg/L NO3-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 NO3-N for significant increase in risk of colorectal cancer

- A critique of ECANs reporting on nitrate

CANTERBURY REGIONAL COUNCIL
Kaunihera Taiao ki Waitaha

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

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 been 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:

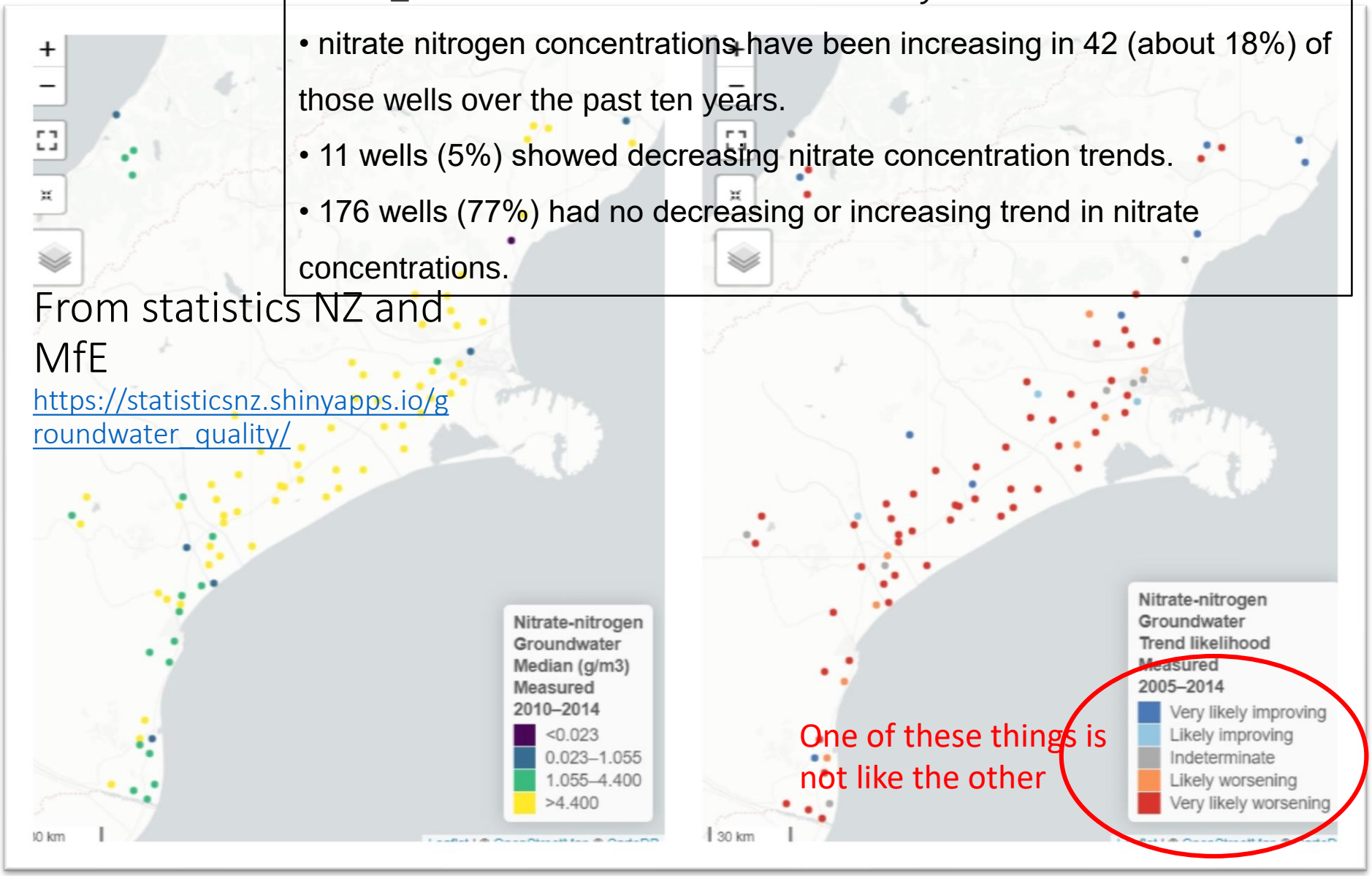
• nitrate nitrogen concentrations have been increasing in 42 (about 18%) of those wells over the past ten years.

• 11 wells (5%) showed decreasing nitrate concentration trends.

• 176 wells (77%) had no decreasing or increasing trend in nitrate concentrations.

From statistics NZ and MfE

https://statisticsnz.shinyapps.io/groundwater_quality/



CANTERBURY REGIONAL COUNCIL
Kaunihera Taiao ki Waitaha

Environment Canterbury Regional Council

Annual Groundwater Quality Survey 2018

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.

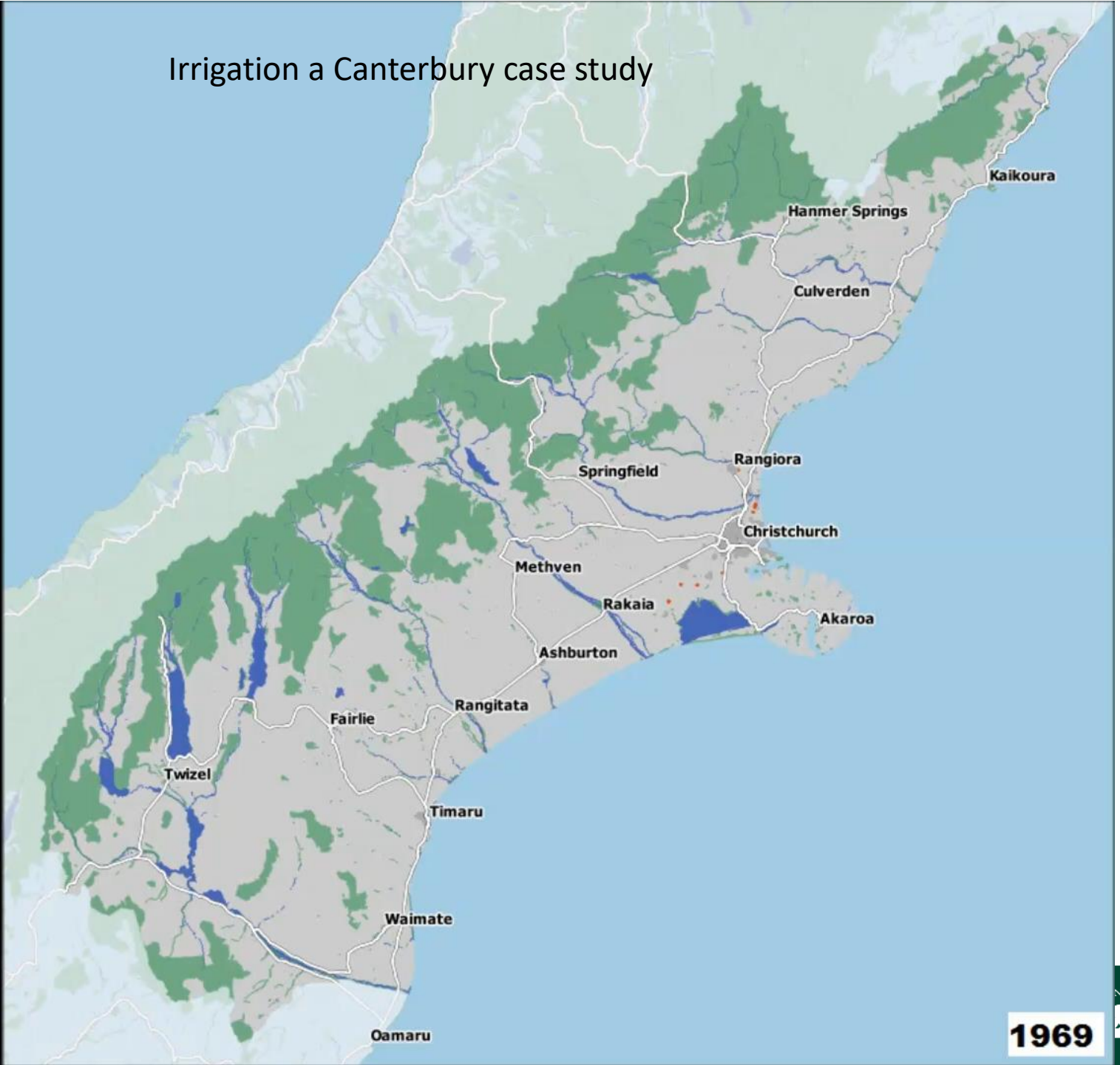
Status	ECAN reporting	Industry standard reporting
Getting worse	**18%**	**66%**
Getting better	**5%**	**20%**
No Change	**77%**	**16%**

Trend direction and confidence	Total Number Of Sites	% in this category
Decreasing trend about as likely as not	23	7
Decreasing trend likely	4	1
Decreasing trend possible	21	7
Decreasing trend very likely	5	2
Decreasing trend virtually certain	9	3
Total declining	**62**	**20.00%**
Increasing trend about as likely as not	36	11
Increasing trend likely	23	7
Increasing trend possible	40	12
Increasing trend very likely	37	11
Increasing trend virtually certain	83	25
Total increasing	**219.00**	**66.00%**
Insufficient non-censored data	16	5
Trend exceptionally unlikely	7	2
Trend extremely unlikely	5	2
Trend unlikely	22	7
No trend	**50**	**16.00%**

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%

Irrigation a Canterbury case study

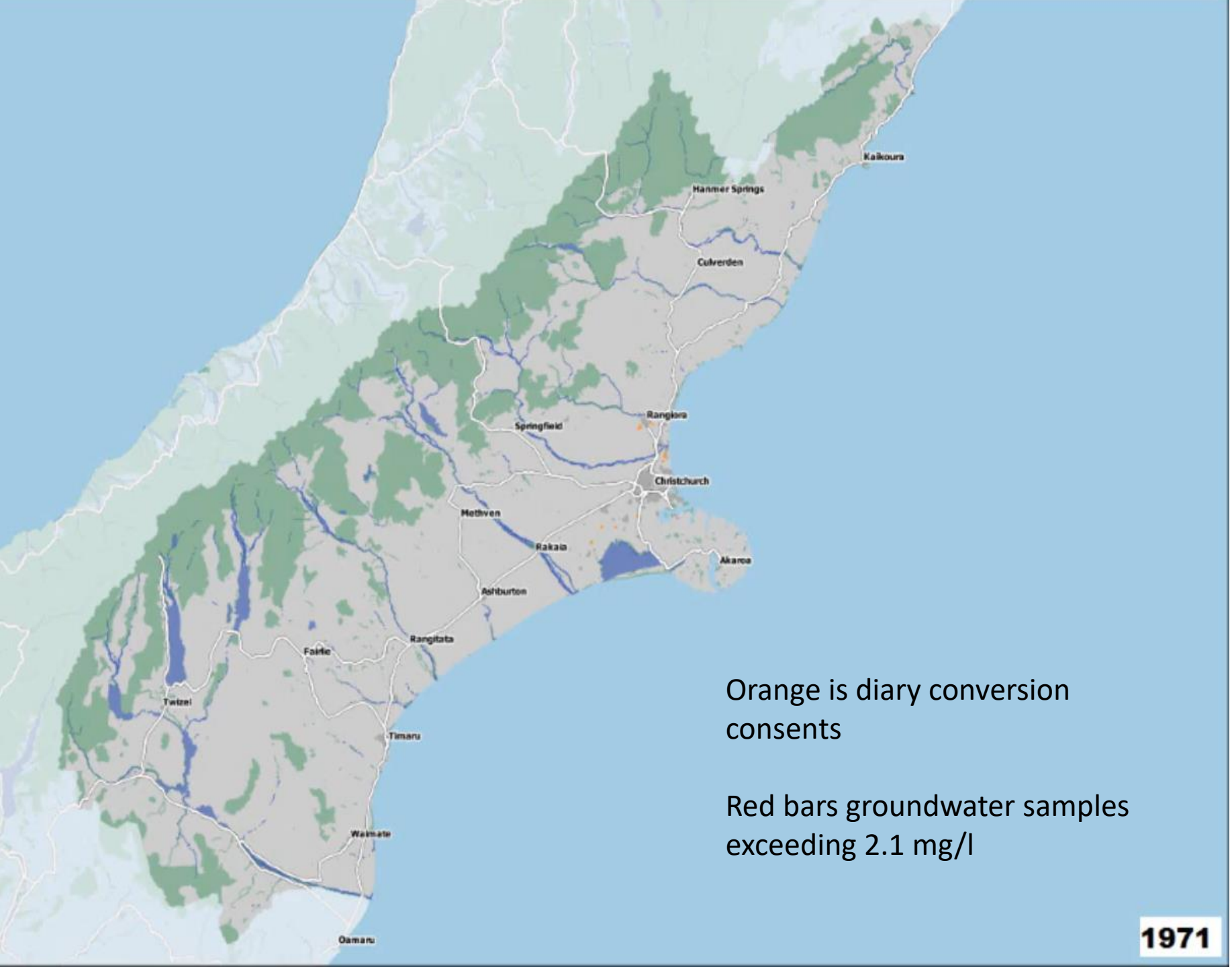


Consents for dairy conversion

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)

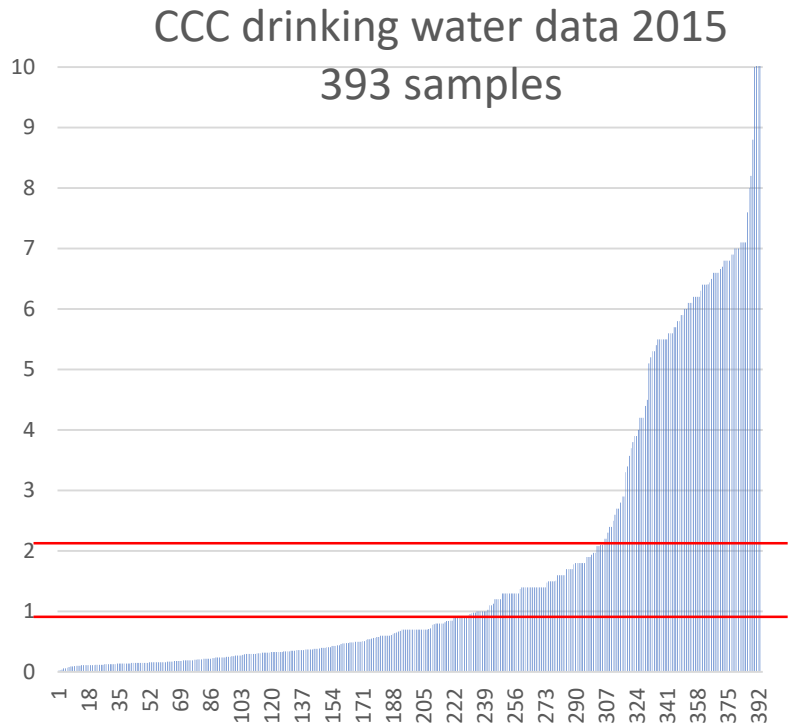


Orange is diary conversion consents

Red bars groundwater samples exceeding 2.1 mg/l

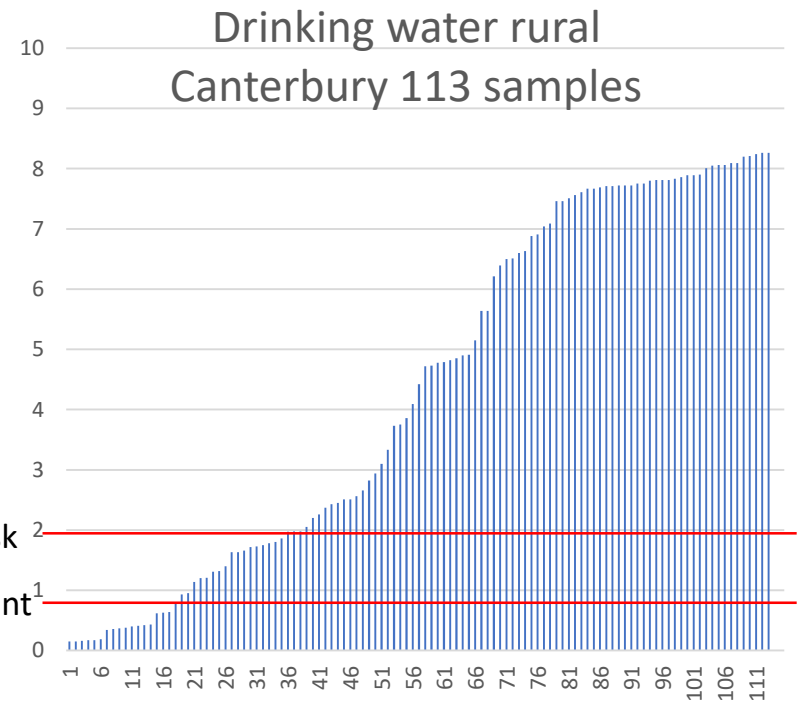
1971

How safe in Canterbury drinking water?



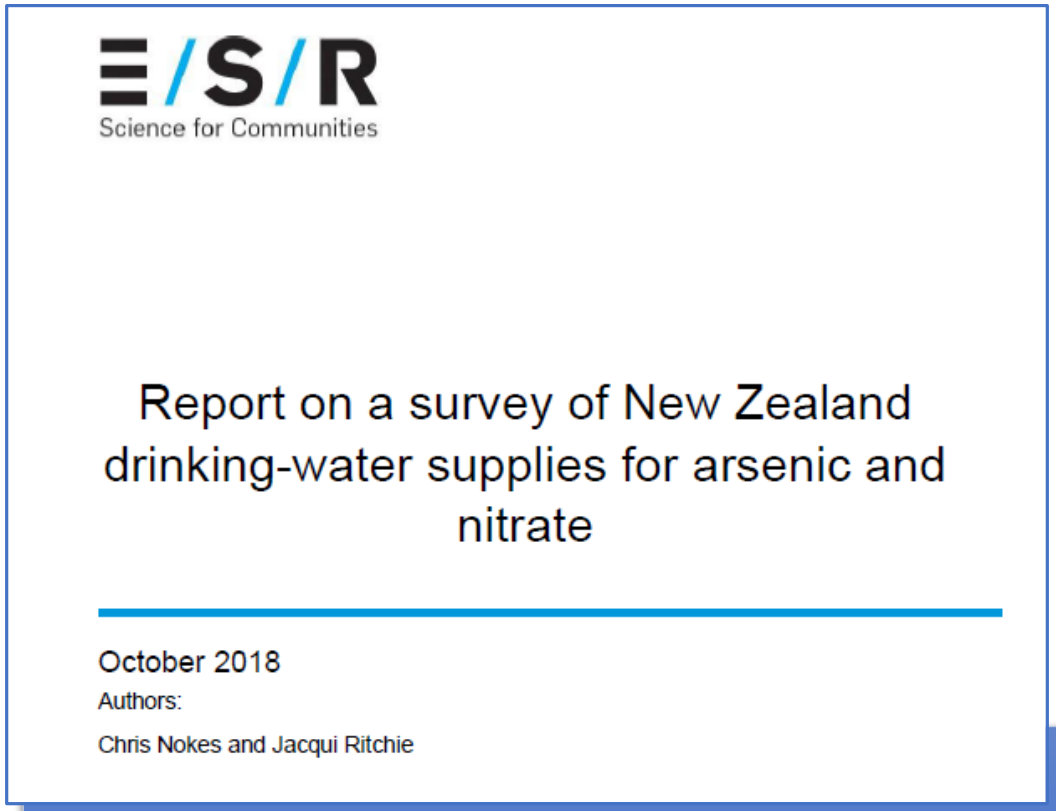
15% risk

Significant risk



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

How safe in Canterbury drinking water?



Region and threshold used	Drinking water supplies to 500 or more people exceeding	Absolute minimum number of people receiving
Canterbury above 2.1 mg/l NO3N	21	10,500
Canterbury above 0.87 mg/l NO3N	66	33,000

The costs now and to come

TUESDAY, JUNE 11, 2019

Alexis Temkin, Ph.D., Toxicologist, and Sydney Evans, Science Analyst

NITRATE IN U.S. TAP WATER MAY CAUSE MORE THAN 12,500 CANCERS A YEAR

EWG's Peer-Reviewed Study Estimates Cases in Each State

Nitrate in U.S. Tap Water May Cause More Than 12,500 Cancers a Year

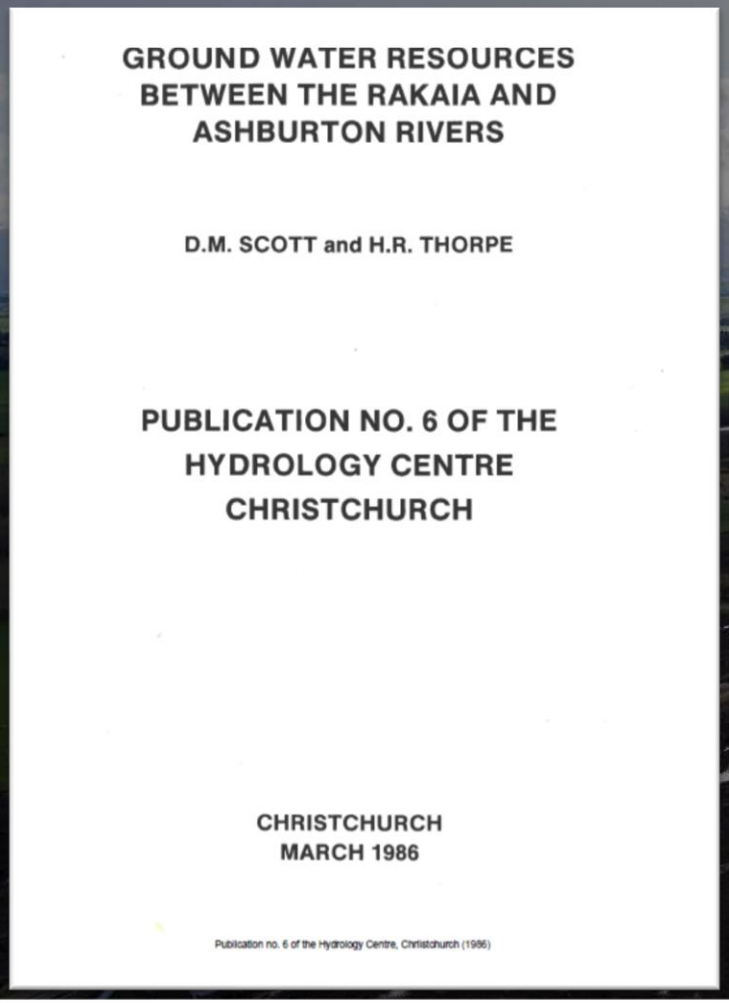
Methodology

LATEST NEWS

USA meta analysis of nitrate pollution of U.S. drinking water showed 3-4% increase in risk for every mg/l increase in nitrate, so may be responsible for up to 12,594 cases of cancer a year, at a cost of up to $1.5 billion for health care

NZ rates of CRC are high by international standards. CRC is the second most common cause of cancer deaths in NZ. The Ministry of Health website reported 3081 CRC cases in 2017 and 1252 deaths in 2013

If we assume that approximately 3-4 percent of the CRC in NZ can be attributed to exposure to nitrate in drinking water (3-4 % per mg/l NO_3-N). This very preliminary estimate would suggest about 120 cases (out of 3,000 pa) and 50 deaths (out of 1,200 pa).


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

(gm m^{-3} = 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 g m^{-3}. An alternative water supply for rural households may have to be considered.

Nitrate fears over cancer link dismissed by Government health bosses

Dominic Harris · 20:44, Jun 13 2019

Ministry of health example of selective myopic avoidance

“Ministry deputy director-general Deborah Woodley said although a "comprehensive review of standards" is under way, it is unlikely to recommend a change to the maximum acceptable level (MAV) of nitrates in drinking water.”

“The Danish study did not fully take into account other risks such as smoking, diet and obesity, and other research needed to be considered, she said.”

Nitrate fears over cancer link dismissed by Government health bosses

Dominic Harris · 20:44, Jun 13 2019

Ministry of health example of selective myopic avoidance

The advice:

- *"this study employed a unique approach to assess the relationship between nitrate drinking water and [colon and rectal cancer] by linking large and long-term … datasets. The main strengths … [are] the study population size, the duration of follow-up, and longitudinal exposure data (water nitrate level) at the individual level.*
- *The authors acknowledge the weaknesses in the study regarding other pathways for [colon and rectal cancer] occurrence (smoking, diet, alcohol, sedentary lifestyle, obesity) …which would likely impact the study findings if they were available ….*"

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

Environmental Management (2015) 56:709–720
DOI 10.1007/s00267-015-0517-x

CrossMark

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

Kyleisha J. Foote[1] · Michael K. Joy[1] · Russell G. Death[1]

'Back of the envelope' insights - 2014

		Forest		Dairy	
	Hectares	28,000		26,600	grazable
LAND	Land value	10,000	$/ha	36,100	$/ha
	Yield/unit	678	m^3/	950	kg milk solids/ha
	Price range	89 to 102	$/m	5 to 9	$/kg milk solids
PROFIT	Surplus range	22 to 32	million $/yr	-6 to 96	million $/yr
	Probabilities of loss	0	%	13	%
	Manufactured Product	67,550	t p	38	million kg whole milk
		275,268	gre mber m^3		
	10-year avg. export price	737	$/t	7	$/kg milk solids
		404	$/m nber	5	$/kg whole milk
	Manufactured exports	161	mil $/yr	179	million $/yr
	Employment: Upstream	84	emp rest/yr	415	emp/farm/yr
	Downstream	280	em ill/yr	175	emp/plant/yr
	Phosphorus	0.05	kg/ r	1	kg/ha/yr
	Nitrogen discharge	3	kg/ r	54	kg/ha/yr
	Nitrogen price	400	$/kg	400	$/kg
	Carbon emitted/stored	11	t CO ha/yr seq	10	t CO_2e/ha/yr emitted
	Carbon price	7	$/t CO_2e	7	$/t CO_2e
EXTERN	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?

Environmental Management (2015) 56:709–720
DOI 10.1007/s00267-015-0517-x

CrossMark

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

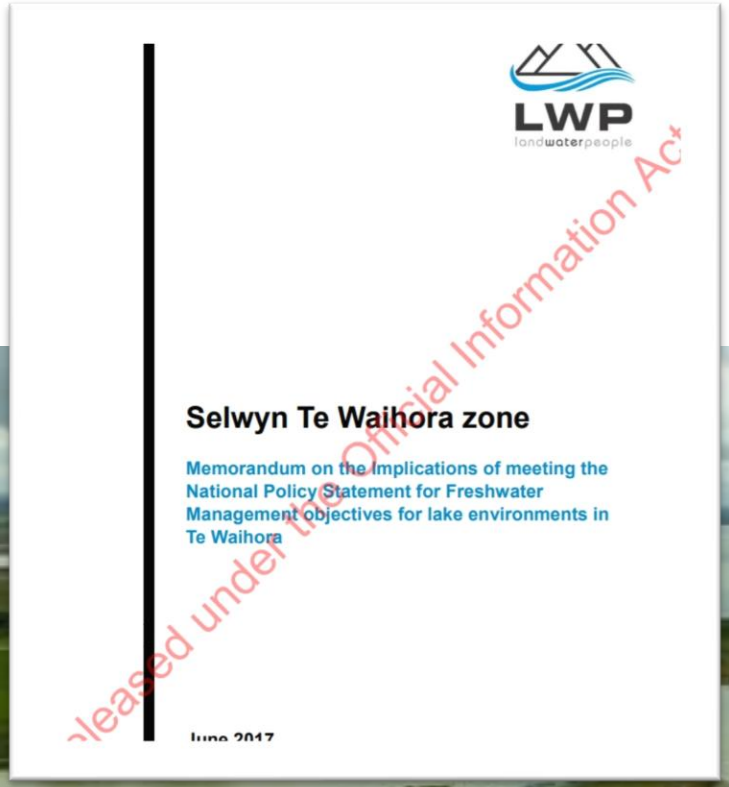
Kyleisha J. Foote[1] · Michael K. Joy[1] · Russell G. Death[1]

'Back of the envelope' insights - 2014

		Forest		Dairy	
	Hectares	28,000		26,600	grazable
LAND	Land value	10,000	$/ha	36,100	$/ha
	Yield/unit	678	m^3/	950	kg milk solids/ha
	Price range	89 to 102	$/m	5 to 9	$/kg milk solids
PROFIT	Surplus range	22 to 32	million $/yr	-6 to 96	million $/yr
	Probabilities of loss	0	%	13	%
	Manufactured Product	67,550	t p	38	million kg whole milk
		275,268	gre mber m^3		
	10-year avg. export price	737	$/t	7	$/kg milk solids
		404	$/m nber	5	$/kg whole milk
	Manufactured exports	161	mil $/yr	179	million $/yr
	Employment: Upstream	84	em rest/yr	415	emp/farm/yr
	Downstream	280	em ill/yr	175	emp/plant/yr
	Phosphorus	0.05	kg/ r	1	kg/ha/yr
	Nitrogen discharge	3	kg/ r	54	kg/ha/yr
	Nitrogen price	400	$/kg	400	$/kg
	Carbon emitted/stored	11	t CO ha/yr seq	10	t CO_2e/ha/yr emitted
	Carbon price	7	$/t CO_2e	7	$/t CO_2e
EXTERN	Externality	31	million $/yr	18	million $/yr

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

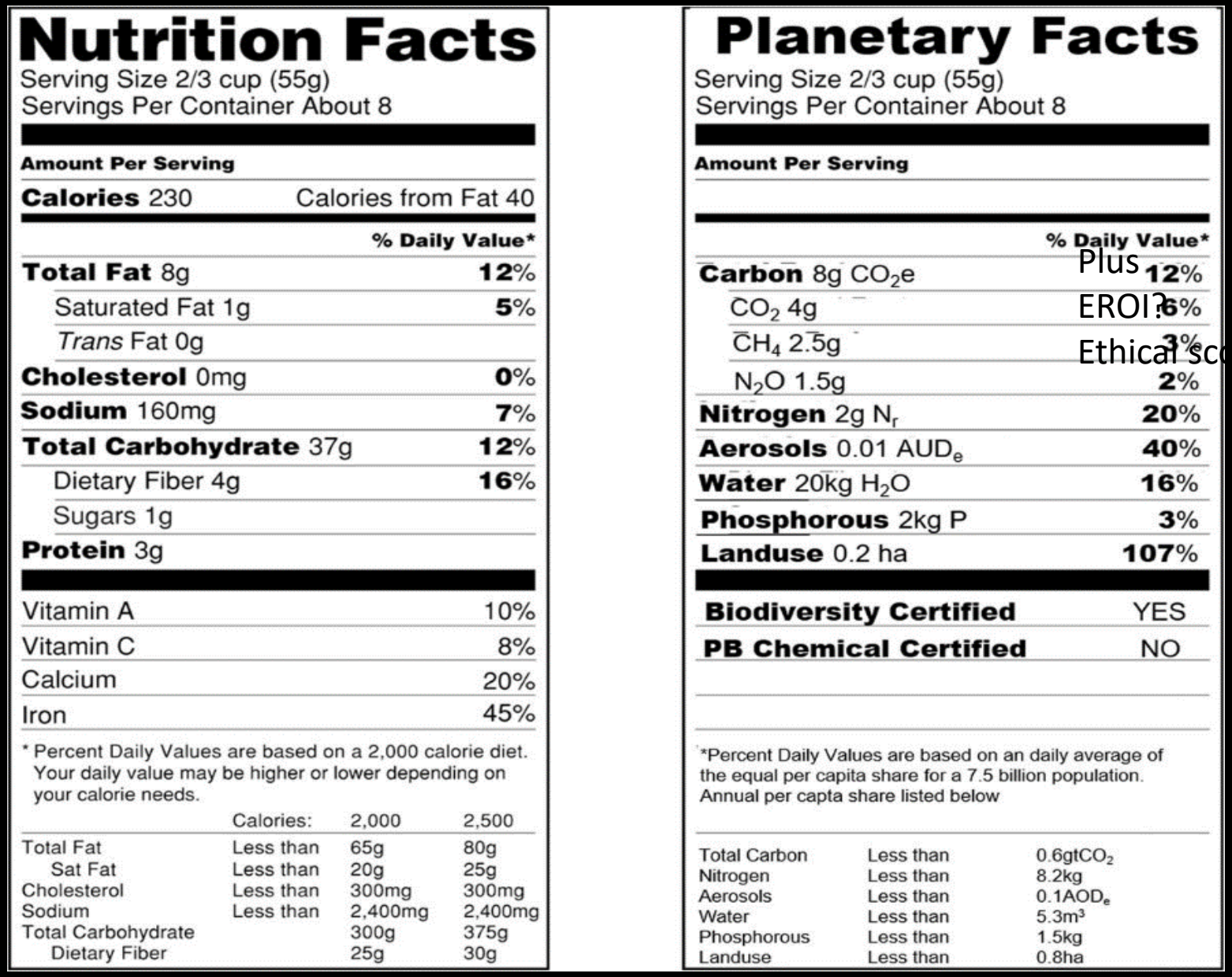


Another Canterbury example of subsidising dairy by allowing externalities

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

The future of food - how will this look for NZ and Canterbury?



Nutrition Facts

Serving Size 2/3 cup (55g)
Servings Per Container About 8

Amount Per Serving

Calories 230	Calories from Fat 40
	% Daily Value*
Total Fat 8g	**12%**
Saturated Fat 1g	**5%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 160mg	**7%**
Total Carbohydrate 37g	**12%**
Dietary Fiber 4g	**16%**
Sugars 1g	
Protein 3g	
Vitamin A	10%
Vitamin C	8%
Calcium	20%
Iron	45%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily value may be higher or lower depending on your calorie needs.

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Planetary Facts

Serving Size 2/3 cup (55g)
Servings Per Container About 8

Amount Per Serving

	% Daily Value*
Carbon 8g CO_2e	**12%**
CO_2 4g	**6%**
CH_4 2.5g	**3%**
N_2O 1.5g	**2%**
Nitrogen 2g N_r	**20%**
Aerosols 0.01 AUD_e	**40%**
Water 20kg H_2O	**16%**
Phosphorous 2kg P	**3%**
Landuse 0.2 ha	**107%**
Biodiversity Certified	YES
PB Chemical Certified	NO

Plus
EROI?
Ethical sc

*Percent Daily Values are based on an daily average of the equal per capita share for a 7.5 billion population. Annual per capta share listed below

Total Carbon	Less than	0.6gtCO_2
Nitrogen	Less than	8.2kg
Aerosols	Less than	0.1AOD_e
Water	Less than	5.3m^3
Phosphorous	Less than	1.5kg
Landuse	Less than	0.8ha

Greywater footprint of dairy in Canterbury

Limits	NO3-N limit mg/l	litres per kg/N required to dilute to limit (=1/kg limit)	WFP greywater footprint litres /kgMS
ANZECC EH lowland guideline	0.44	2,272,727	136,012
ANZECC EH upland guideline	0.67	1,492,537	89,321
Ruataniwha BOI ecosystem health	0.8	1,250,000	74,807
Colorectal cancer significant increase risk	0.87	1,149,425	68,788
Toxicity for pristine 99% National Objectives framework band A bottom line	1	1,000,000	59,845
Colorectal cancer 15% increase risk drinking water	2.1	476,190	28,498
NOF B	2.4	416,667	24,936
NOF C toxic	6.9	144,928	8,673
WHO drinking water MAV	11.3	88,496	5,296
Very localised point source	20	50,000	2,992

Other issues with synthetic nitrogen fertilser

- until 1990s was from natural fixation using clover but now from fossil fuels
- each kg urea has 52Mj of embodied energy
- each kg urea emits 12 kg CO2e
- only 17% of the N applied as fertiliser makes it to the food we eat the rest mostly leaks out to do harm in the environment
- each kg of urea applied to soil, ~ 3% ends up in the atmosphere as nitrous oxide (N_2O), 300 times more potent GHG than CO_2 and N_20 is the most ozone-depleting gas.
- pre-industrial < 270 ppb N in atmosphere now > 320 ppb
- eutrophication of waterways rivers, lakes and oceans – 400 dead zones covering 245,000 km^2

Demonstration dairy farm cuts nitrate leaching 30 per cent and stays profitable

10:00, Sep 21 2017

- Lincoln University Dairy Farm, through a reduction in external inputs and the size of its herd (from 630 to 560 cows), increased its production (from 400 kgMS to over 500 kgMS per cow) and profitability, while decreasing its nitrogen leaching (by 30%).

Example of utter failure of ECAN nutrient reduction policy disincentivising improvement

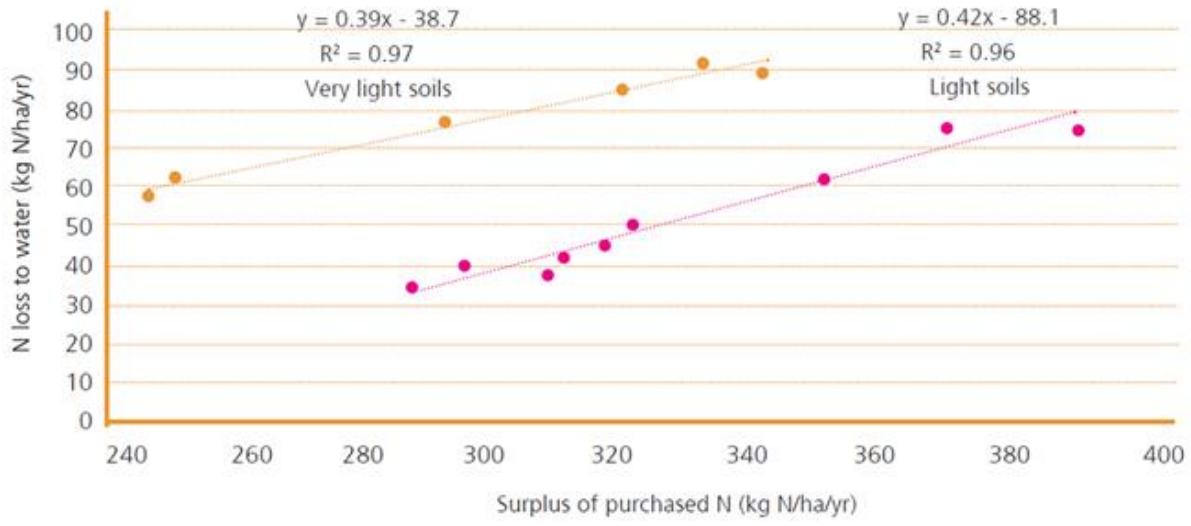
- The Pamu experience with nitrogen reduction in Canterbury
- 50% (2035 target in 1 yr) reduction in N, but no net gain for environment because shared out
- And land value drop

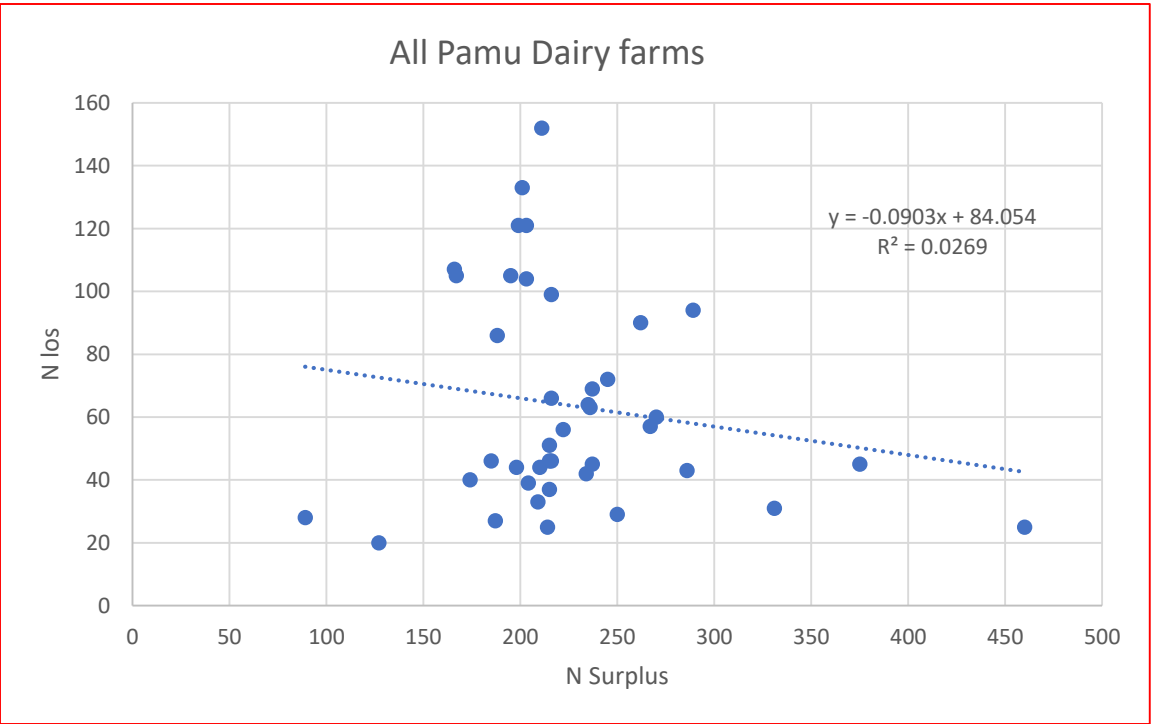
The avoidance game

A list of the attempts by industry enabled by central and local government to avoid a realistic nitrogen limit so far:

- Limiting nutrients
- NPS toxicity
- Managed Aquifer Recharge MAR (aka. robbing Peter to pay Paul)
- N-surplus

Figure 1. Overseer 6.3.0 three-year estimates of N loss to water (predominantly N leaching) and farm N surplus for five Canterbury dairy farms[3]





On dairyNZ webpage and their reports N-surplus is perfect predictor of N loss to environment (and MPI)

Here is real data not self selected to tell a story

You have seen some of the farce that is freshwater management in NZ

Cock-up or conspiracy?

- If cock-up we would expect results to be random i.e. some overly protective some weakening protection

- Why do we have to resort to public campaigns and courts to get authorities to do their job protecting the environment?

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. Alternative drinking water supply for Canterbury?

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

Buy from good New Zealand bookshops or online at www.bwb.co.nz

BWB BRIDGET WILLIAMS BOOKS

Activism is my rent for living on this planet
(Alice Walker)

'Toi tū te whenua, whatungarongaro te tangata' – the land stands, while people come and go

Doing nothing will not make you immune to the consequences

www.waterqualitynz.info

Thanks to:
Victoria University
IGPS,
Freshwater activist friends
students &
colleagues all over New Zealand

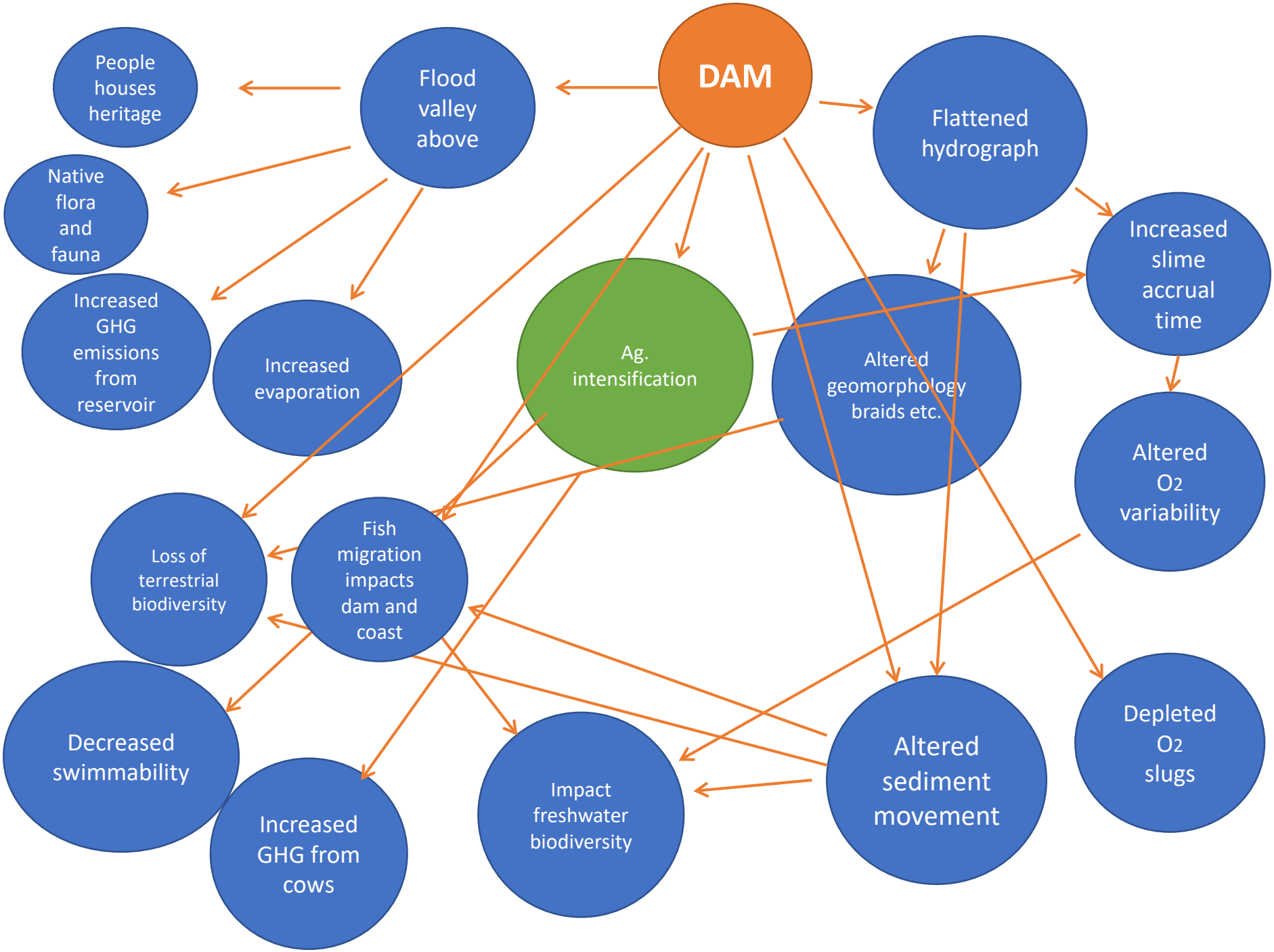
Capital thinking. Globally minded.

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA UNIVERSITY OF WELLINGTON

Human edible protein per hectare

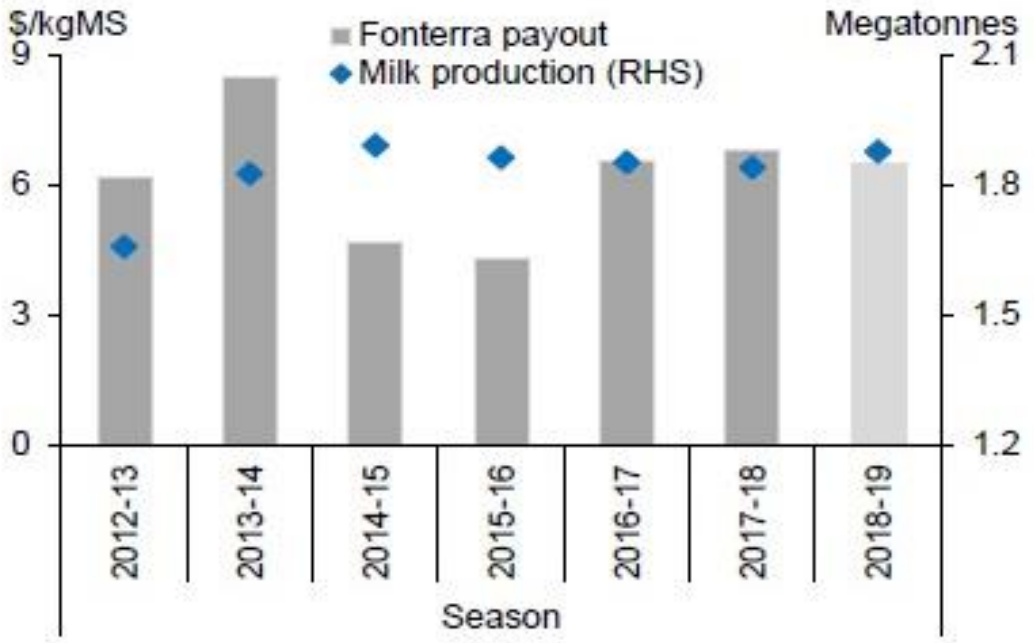
Foods	Kg Usable Protein / ha	Water use /kg protein
Soybeans	833	
Faba beans	1295	4,500
Wheat	726	22,500
Milk	707	29,400
Beef	14	

Leftfield Innovation Limited


DAM
People houses heritage
Flood valley above
Native flora and fauna
Increased GHG emissions from reservoir
Increased evaporation
Ag. intensification
Flattened hydrograph
Increased slime accrual time
Altered geomorphology braids etc.
Altered O2 variability
Loss of terrestrial biodiversity
Fish migration impacts dam and coast
Decreased swimmability
Increased GHG from cows
Impact freshwater biodiversity
Altered sediment movement
Depleted O2 slugs

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.

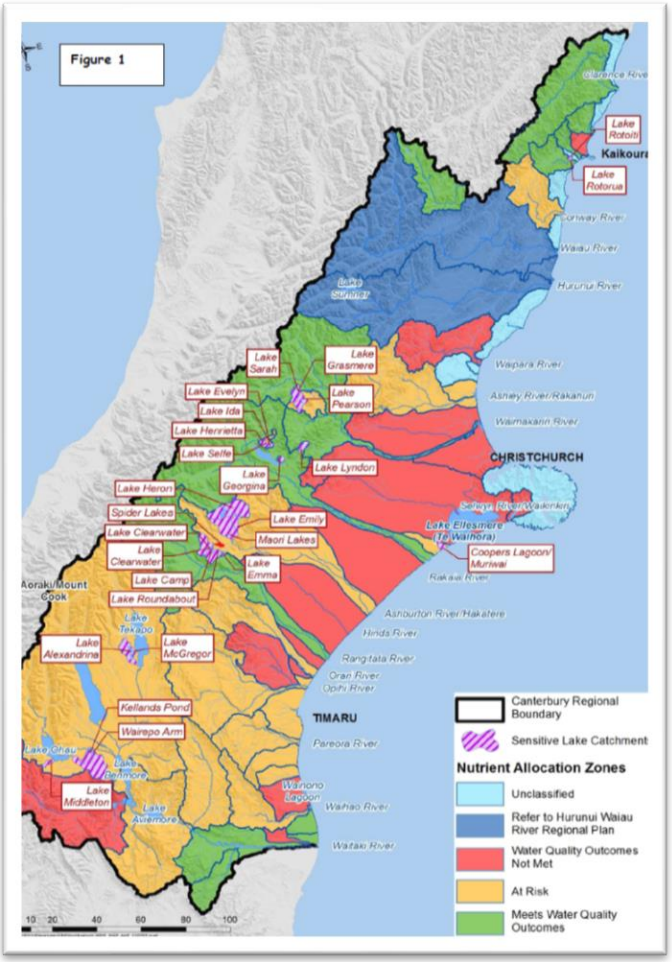
- South Island dairy cattle have increased from 0.6 million in 1994 to 2.6 million in 2017. Most of this increase occurred in Canterbury (1.1 million), Southland (0.6 million), and Otago (0.3 million). Over the same period beef cattle numbers in the South Island have stayed relatively stable (just above 1.0 million). https://www.stats.govt.nz/indicators/livestock-numbers

- he 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



1. Regional Plan Policy: Inequity of grand parenting.
2. Declining Water Quality: Nitrate load upward, Aquifers, Spring fed streams
3. Wrong Limits 3.8 mg/l
4. Human disease: high rates zoonotic disease (via water?)
5. Biodiversity Loss waterways and terrestrial
6. Over reliance on Models. Overseer etc.
7. Legal: Drinking Water Degradation
8. Fair representation: Zone Meetings, GMPs and FEPs….
9. Ethics: Worsening Water Quality in just 10 years.
10. Debt Burden: Land values anchored to polluting systems

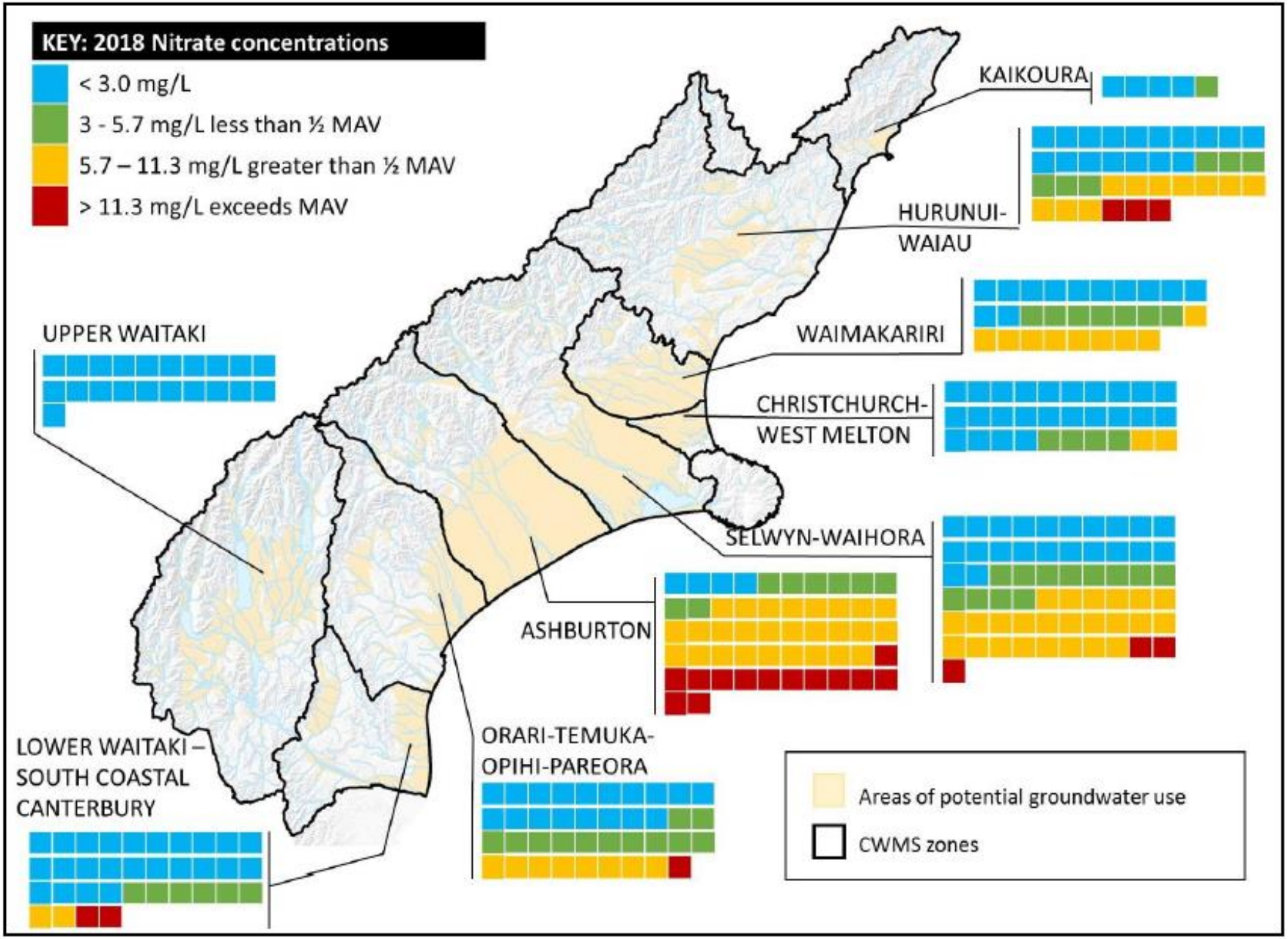
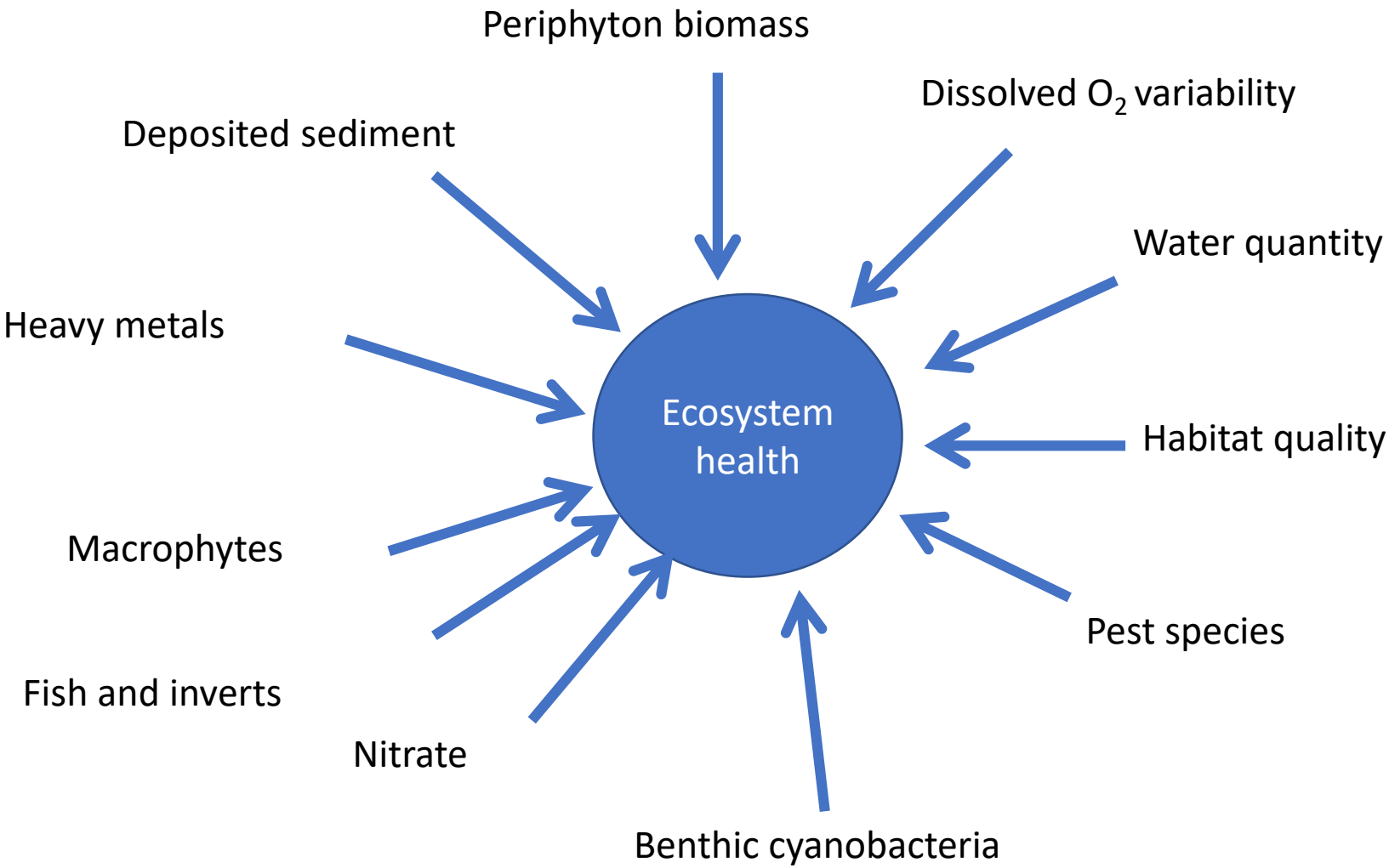


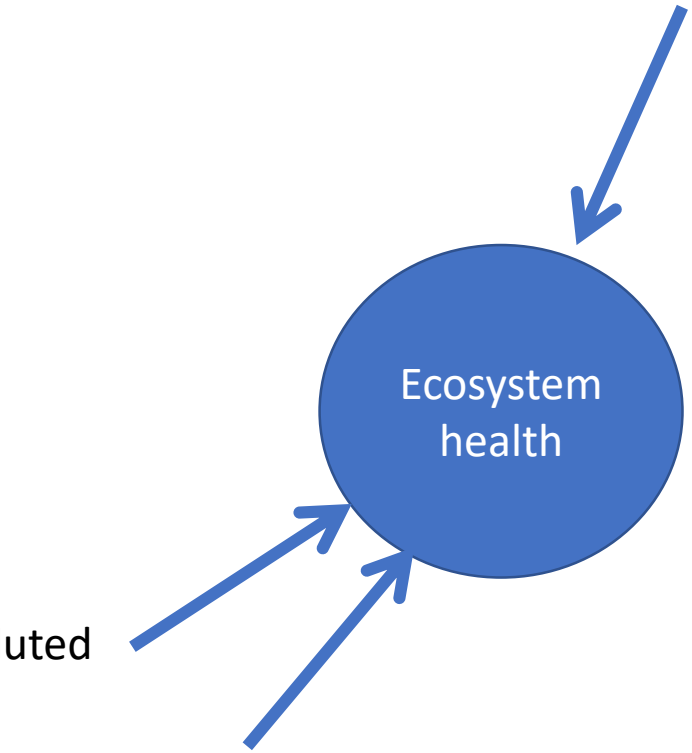
Figure 4: Summary of nitrate concentrations sampled in the 2018 annual survey for each CWMS zone

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