POURAKINO CATCHMENT

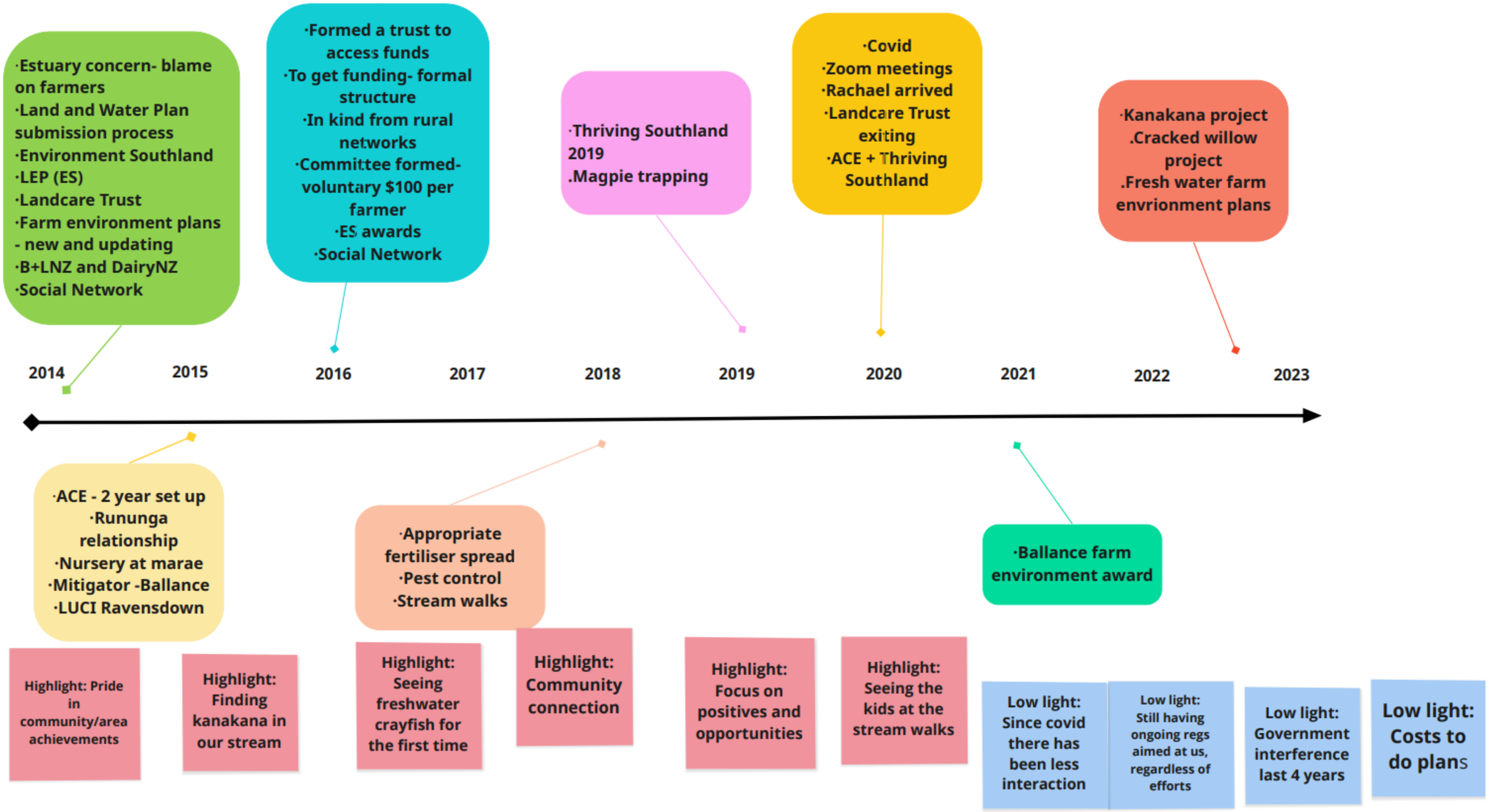
CONSERVATION TRUST

Pourakino Catchment
AgResearch project

Robyn Dynes + Helen Percy

Action Research

1. The group
2. Issues that matter
3. Collective identification of actions
4. interviews


·Estuary concern- blame on farmers ·Land and Water Plan submission process ·Environment Southland ·LEP (ES) ·Landcare Trust ·Farm environment plans - new and updating ·B+LNZ and DairyNZ ·Social Network
·Formed a trust to access funds ·To get funding- formal structure ·In kind from rural networks ·Committee formed- voluntary $100 per farmer ·ES awards ·Social Network
·Thriving Southland 2019 .Magpie trapping
·Covid ·Zoom meetings ·Rachael arrived ·Landcare Trust exiting ·ACE + Thriving Southland
·Kanakana project .Cracked willow project .Fresh water farm envrionment plans
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
·ACE - 2 year set up ·Rununga relationship ·Nursery at marae ·Mitigator -Ballance ·LUCI Ravensdown
·Appropriate fertiliser spread ·Pest control ·Stream walks
·Ballance farm environment award
Highlight: Pride in community/area achievements
Highlight: Finding kanakana in our stream
Highlight: Seeing freshwater crayfish for the first time
Highlight: Community connection
Highlight: Focus on positives and opportunities
Highlight: Seeing the kids at the stream walks
Low light: Since covid there has been less interaction
Low light: Still having ongoing regs aimed at us, regardless of efforts
Low light: Government interference last 4 years
Low light: Costs to do plans

Prioritised Problems/opportunities

(11 votes)

- *E.coli* in the Omutu river.
- *E.coli*: track, identify sources, modify if needed.
- Determine the source(s) of *E.coli* in Omutu stream.
- Waterfowl contamination
- *E.coli*: Test -> Action.

(8 votes)

- How much soil movement is there in the catchment and what can be done to improve the outcomes?
- Sediment shift from riverbanks.
- Sediment loss in fenced off waterways.
- On farm action: sediment control, soil management, riparian planting.

(7 votes)

- Streamline regulations – currently multiple different farms/plans that are needed for the same information
- Empower farmers to own their data/ information: understand what/ where needed

(6 votes)

- Gravel build up

(5 votes)

- Biodiversity corridors through catchment

(4 votes)

- Improve farmer wellbeing.
- Get back to wider group commitment on a positive track.
- Staff remote living.

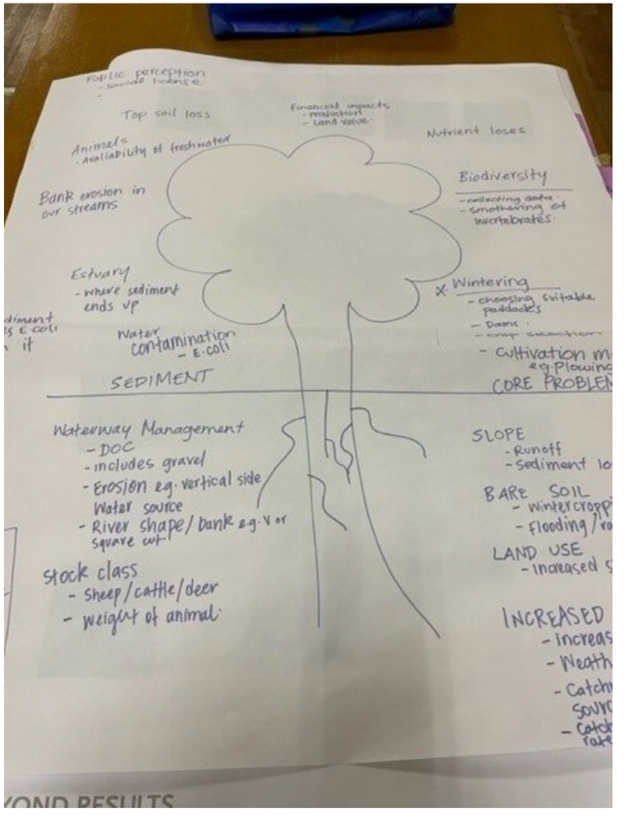
Problem Tree: Data Sharing

Consequences: What are the impacts of the problem?
- •Cost so rent out farming (check- not sure I have this correct).
- •Farmers are less likely to embrace new (?) check last word.
- •Pay consultants to do the work.
- •Stress.

Core Problem: Repetition and replication of the same info.

Causes: Why has the problem occurred?
- •New players (Halter etc).
- •Sharing data is complicated.
- •Everyone has joined environmental bandwagon, but not collaborated.
- •No centralised regulator. So many layers.
- •Confusion amongst other
- •Issues around privacy.
- •IP.
- •Competition between businesses
- •Banks are important player.

- •Data set of information that catchment agreed on.
- •Clarity on freshwater farm plans.
- •Comparison against other areas in NZ – farmers, businesses, and industries.



Problem Tree: Nutrients

Consequences: What are the impacts of the problem?

•Public perception – Social licence.
•Topsoil loss.
•Financial impacts – production, land value.
•Animals – availability of fresh water.
•Nutrient losses
•Bank erosion in our streams
•Biodiversity- collecting data, smothering of invertebrates.
•Estuary- where sediment ends up.
•Sediment causes E. coli.
•Water contamination- E. coli.
•Wintering- choosing suitable paddocks, dams, crop selection, cultivation method (e.g., ploughing/direct drill).

Core Problem: Sediment

Causes: Why has the problem occurred?

•Waterway management
-Doc
-Includes gravel
-Erosion e.g., vertical side
-Water source
-River shape/bank e.g., v or square cut.
•Stock class
-Sheep/cattle/deer
-Weight of animal
•Slope
-Run off.
-Sediment loss.
•Bare soil
-Winter cropping post.
-Flooding/rainfall.
•Land use
-Increased stock
•Increased rainfall
-Increased intensity.
-Weather event.
-Catchment areas – critical source areas.
-Catchment has high rainfall rates in South Island.

<u>**Problem Tree: E. coli**</u>

Consequences: What are the impacts of the problem?

- ? (can't read these top post-its)
- ?
- ?
- ?

Core Problem: Water Quality

Causes: Why has the problem occurred?

- Phosphorus.
- Nitrates.
- E. coli.
- Don't know.
- Wild birds.
- Duck shooting too short.
- (?)____ tanks (first word is covered with another post-it)
- Trampers.
- Wild animals- deer, pigs, possums.

- What don't know- pattern + distribution of E. coli.


Interviews

- 12 farms in catchment

- 10 farms associated with catchment group
- 2 farms with no formal association

We found:

- Interviewees expressed a **strong sense of place** and link to the physical environment
- Interviewees expressed a clear view that farmers in the catchment were – mostly – '**doing the right thing'** for the environment
- Most interviewees were able to articulate **on-farm practice change** that they had undertaken to mitigate environmental impacts (in particular winter grazing practices and riparian planting)
- Interviewees could articulate the **challenges facing the catchment**
- Many could articulate **a vision for the catchment** – often based on healthy waterways, and the recreational opportunities that healthy waterways can provide.

This suggests that:

- *individually and collectively, that some of '**precursors of change'** (attitudes, beliefs and values) **are already in place**. The ability to articulate challenges, opportunities and vision for the future (even if they weren't all the same), and well as the things that are being put in place to get there, was **impressive.***

What emerged was: need for more systemic approach to implementing and measuring change to address catchment challenges

- **So we recommend the following:**
  - Complex issues like this means there isn't a clear solution (or research) so it's more about **experimenting and trying out some ideas.**
  - But linked to that it is about **measuring and monitoring** change with everything you do – whether it is specific water quality monitoring, or **capturing feedback** from events and those participating in the group.
  - Focus on the short, mid and long term **outcomes,** and the activities – what you do – follows on from there.
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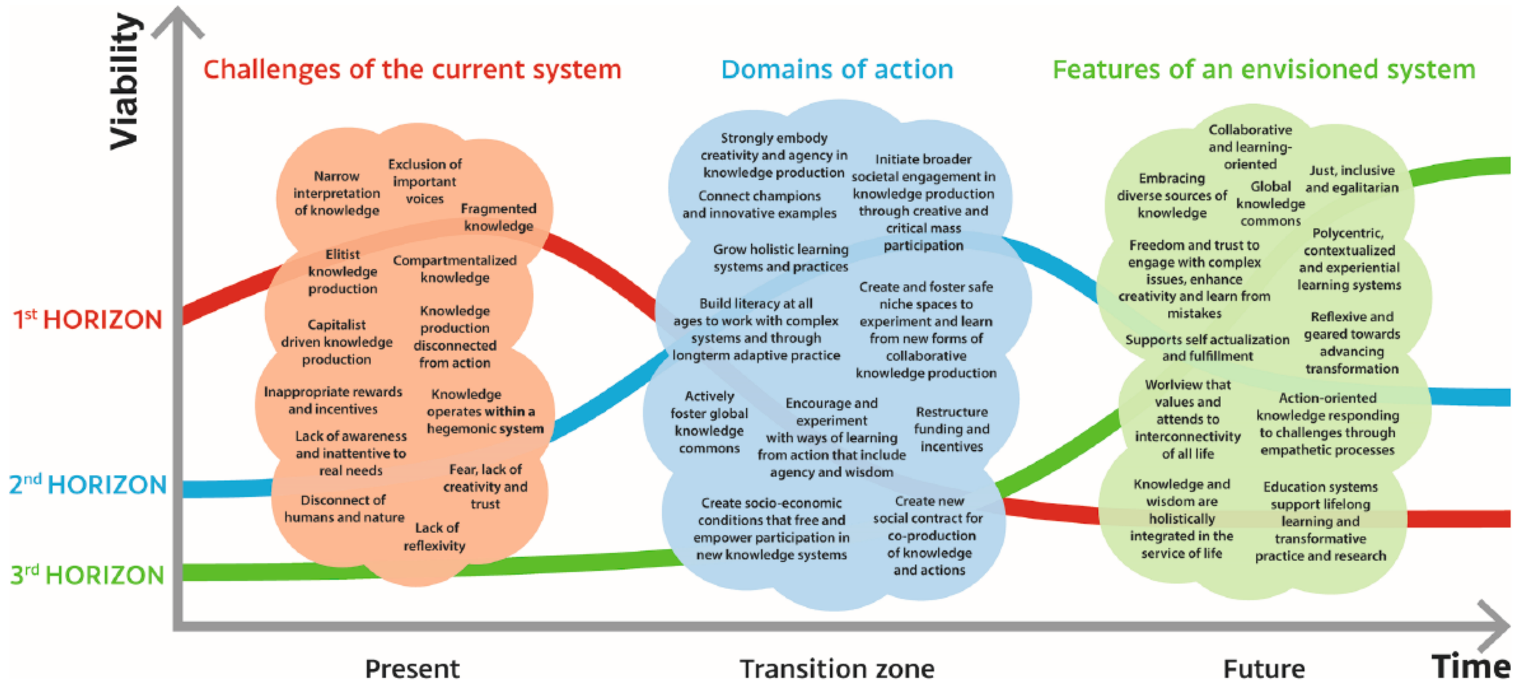


Fig. 2. Pattern shifts from current challenges to future envisioned systems more able to support emergence of regenerative and equitable futures, with key domains of policy and action that are needed to help this shift emerge.

Example of format to show transition over time (3 Horizons framework). I've proposed we adapt by adding in a 'past' on the time-line

Pourakino Catchment level

Past

Pre 2014: concerns around estuary – blame on local farmers

Recognition that the landowner needed to take more responsibility for water quality

Current challenges

Maintaining the natural ecosystem
Biodiversity and habitat loss
Water quality: streams and estuary (esp. *E.coli*)
Sediment loss
Financial viability
Public pressure (including urban)
Animal pests: deer, pigs, possums
Measuring and quantifying impacts (environmental and also social)
Keeping farmers in the catchment engaged with the Catchment Group
Farm succession

Transition: things that are happening to take us to the future

Kanakana project
Field days
Riparian planting
Freshwater farm plan implementation
Involvement of local Rūnanga alongside Catchment group

Mitigation actions (at individual level) e.g. winter-grazing, de-intensification, (list out from notes)

Younger people involved in Catchment Group

Engaged farmers are positive role models in the community

Catchment group as a platform for sharing knowledge and learning from each other

Catchment group taking a broader view: not just water quality
Focus on 'doing' positive things

Local voice can be a strong voice

Future state

Thriving communities
Healthy waterways that can be used for recreation (including fishing and kayaking)

Unified approach/ shared vision (wider than just the catchment group)
Evidence-based, scientifically-based recommendations
Balanced on-farm emissions with practical approaches

NZ agri-food system level

Past

Focus on business growth, intensification, growing value (esp. following removal of subsidies in 1980s)
Land development
Capital gain

Current challenges

Environmental and biophysical pressures: water quality, biodiversity, GHG emissions

Regulation and compliance pressures
Financial returns (especially sheep farmers)
Lack of clear guidance and incentives from government and industry for environmental practice
Lack of practicality in government and industry requirements
Lack of clear and practical solutions
Mixed messages from different processors/ sectors

Transition: things that are happening to take us to the future

Catchment group community helps farmers develop and implement sustainable practice

Role of others in supporting farmers (industry bodies, researchers, Thriving Southland etc.)

Future state

Collective action/ strategy/ goals (across whole industry)

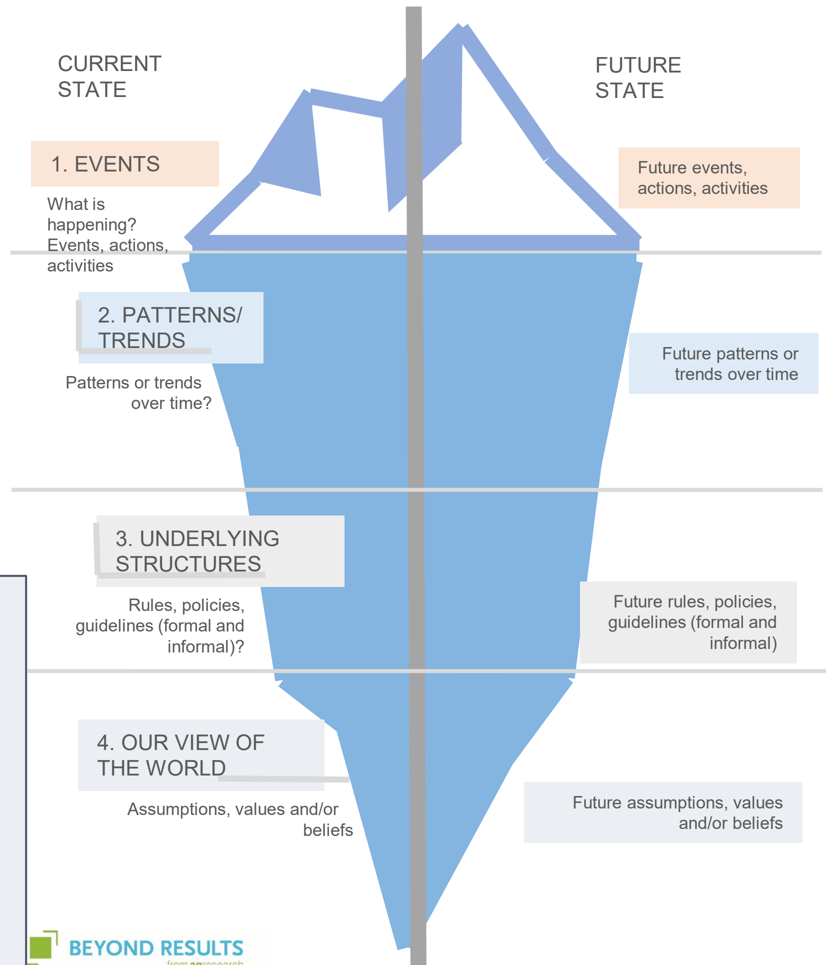
“Market driven (as opposed to regulation driven)”

Improved financial reward and recognition of sustainable farming practice

Adapting to changing consumer preferences

Balance between environmental sustainability and profitable farming

THE ICEBERG MODEL



Catchment group that has been on-going for 10+ years. A number of projects and events over the years

Change of on-farm practices e.g. wintering practices, riparian fencing
Increased personal and collective responsibility for environmental practice
Changes in physical environment, e.g. estuary 'black film, stinks'
Decreasing economic returns, especially sheep

people
Informal: 'peer pressure' around resonsible farming
Informal: Catchment group is a platform for sharing knowledge and learning from each other
Formal: Freshwater Farm Plans and other farming regulations

Catchment group has a role in keep the community together
(Most) farmers aim to 'do the right thing' (environmentally) even if it makes farming more difficult
Some farmers aren't following best practice
'Rules and regulations not practical nor fair'
Other organisations don't always play their part/ support farmers
Pride in being able to contribute to clean waterways in the catchment
Environmental concerns are not the sole responsibility of farmers: everyone has a role to play.
Townies also affecting water quality
Science helps with options; measures and monitoring

"Waterways as assets to be managed, not just drains to be cleared"
Cautious optimism about sectors
…

So what? Next steps

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- Opportunity for AgResearch Invermay based water quality scientists (and others e.g. Justin Kitto and Thriving Southland), to start the ball rolling with presentation/ Q&A session on E coli and water quality with specific application for this catchment, with the intent of on-going shared research.

- AgResearch continues to play a brokering role to provide a link to the Pourakino in specific research or information areas (*E. coli*, GE etc.).

-

- The work presented here can be picked up by the catchment group to use for strategic planning and other applications, e.g. for future funding. Robyn and Helen are happy to work through this with the group, for example completing the diagrams here and helping with questions about future focus. Also, picking up on the baselining and on-going monitoring of tangible change in the Catchment group : put this into a Theory of Change (like a programme logic) – which combines both biophysical and KASA (Knowledge, Attitudes, Skills, and Aspirations) which are considered a precursor to practice change. This is something that other catchment groups have expressed an interest in, so we are keen to try it out.

Acknowledgements

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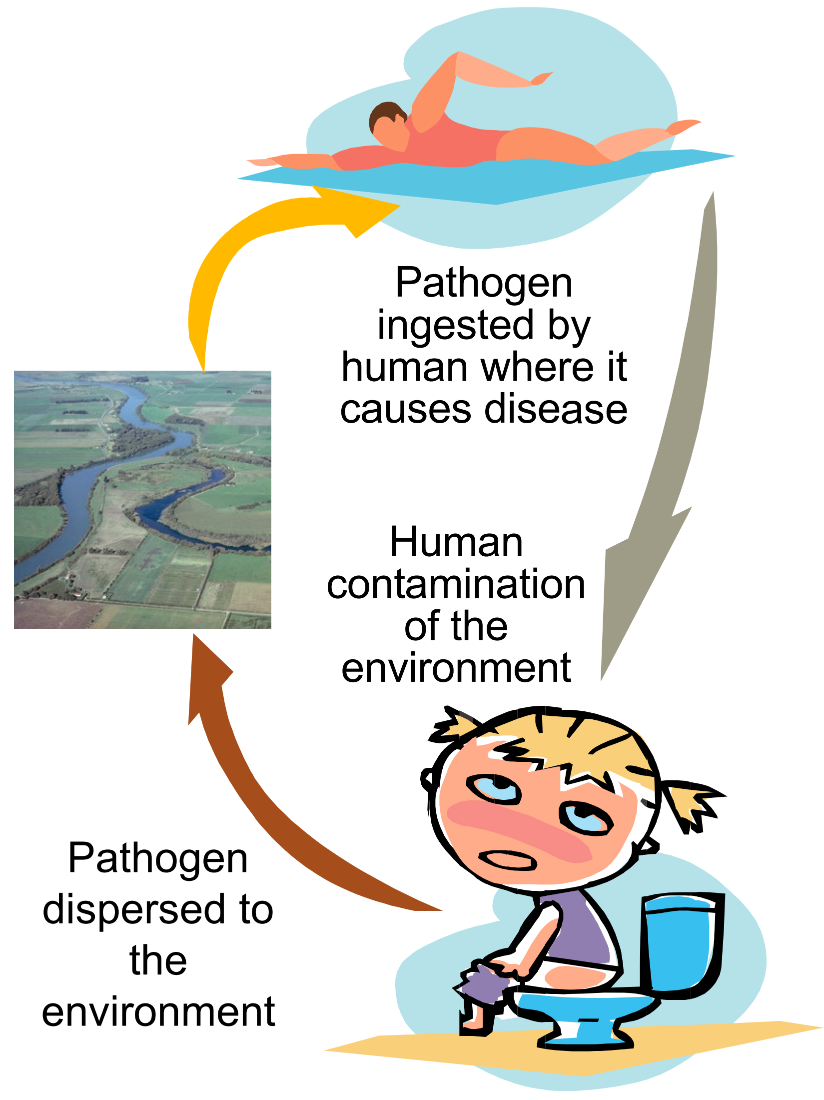
- Thank you very much to the Pourakino community, especially to everyone participated in the interviews and generously shared your time, your ideas, and your hospitality. Thank you also to Rachael Halder and Richard Kyte at Thriving Southland for your guidance.
- Many thanks to our AgResearch colleagues, Steve Cantwell and Roxanne Henwood for help with the interview preparation and analysis, and to Anna Edwards to assistance with the initial workshop.
- Funding for this work was through the T-Platform (MBIE Strategic Science Investment Fund).

Faecal microbial impacts on water quality

- POURAKINO CATCHMENT - SOUTHLAND
- RICHARD MUIRHEAD – OCTOBER 2024

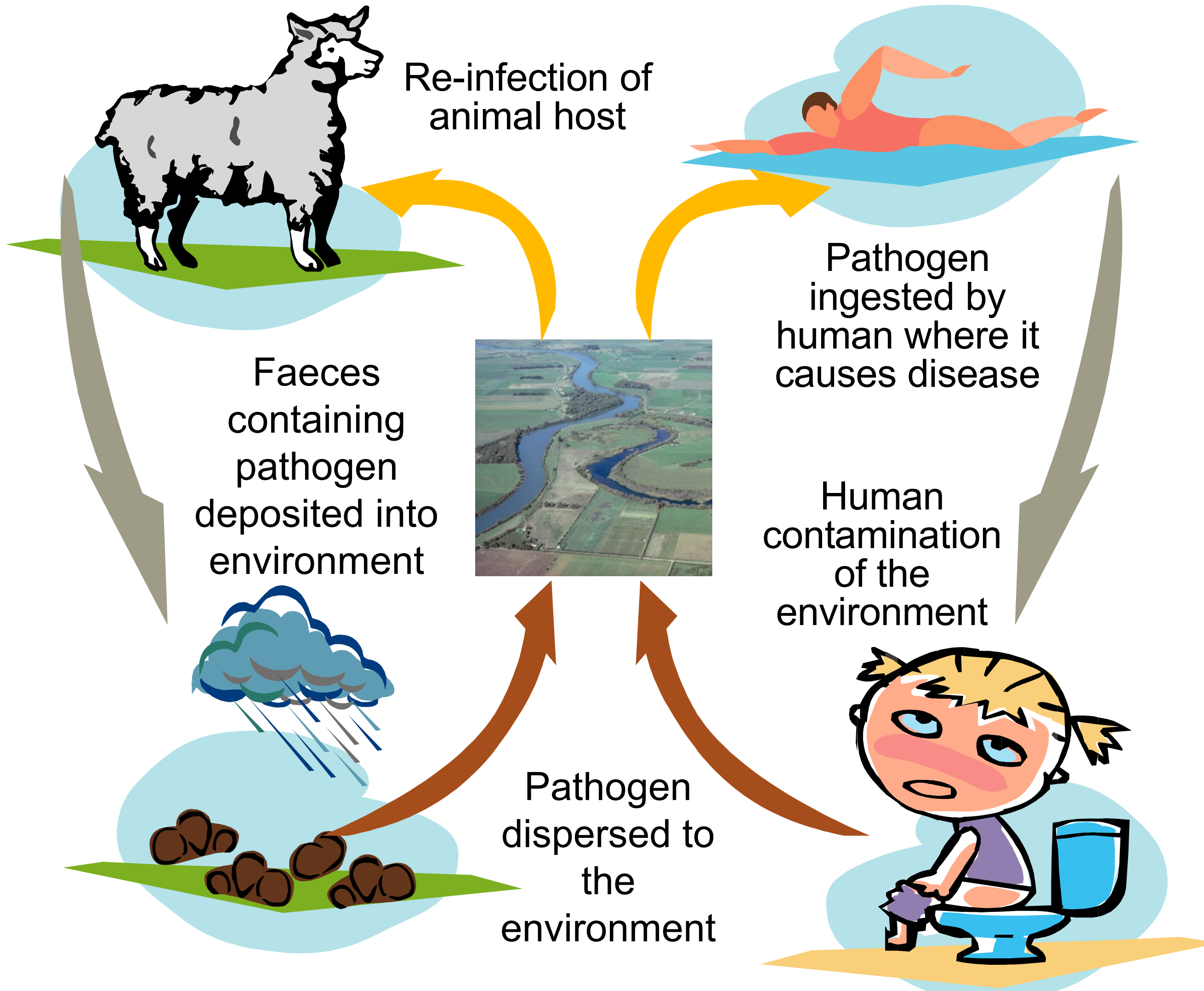
Why faecal microbes?

Faecal Oral Cycle



Why Agriculture?

Zoonoses



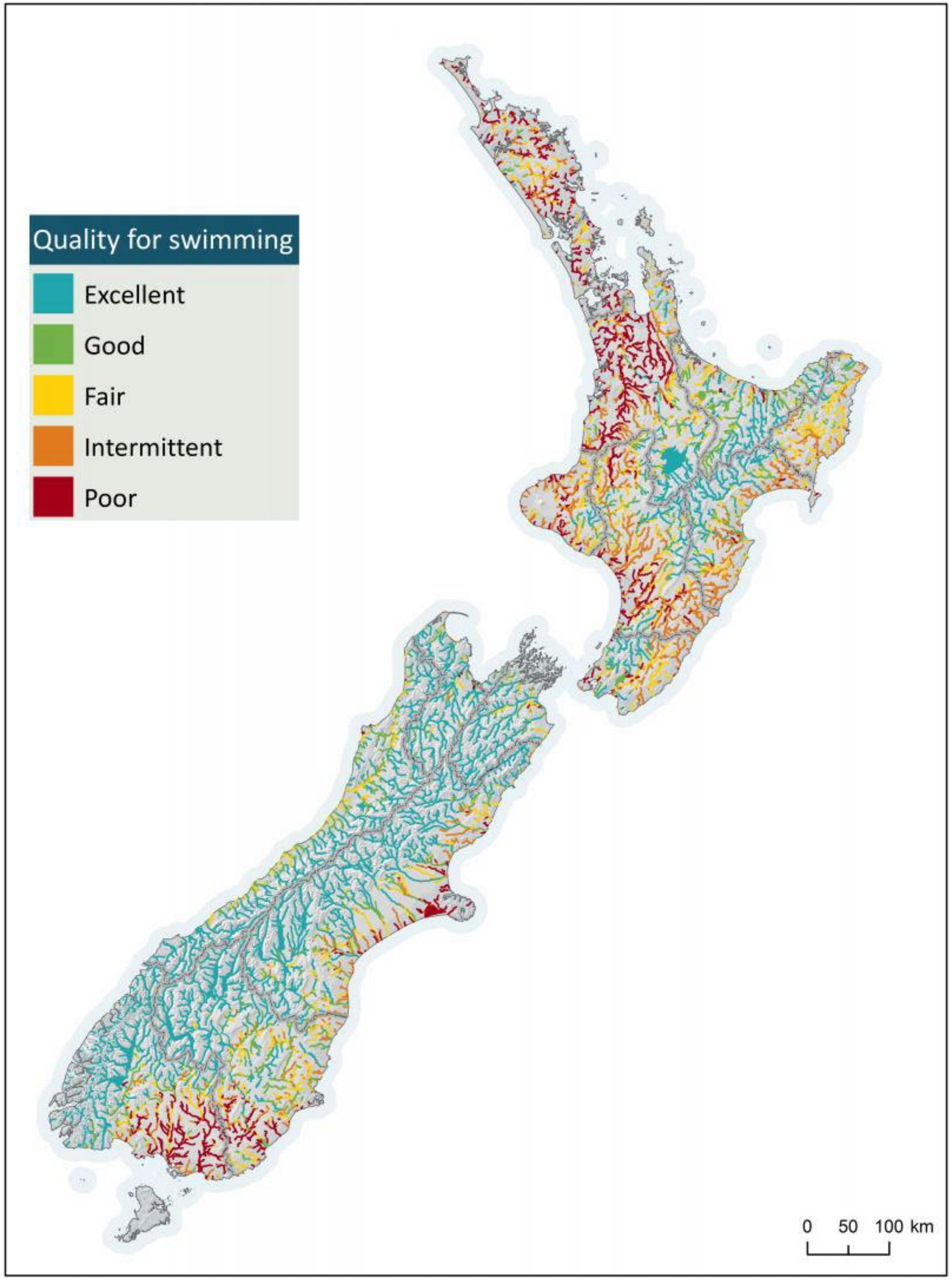
Why Agriculture?

- **Zoonoses**

- *Campylobacter*
- *Salmonella*
- *Cryptosporidium*
- *Giardia*

- New Zealand has the highest rates of zoonoses in the developed world

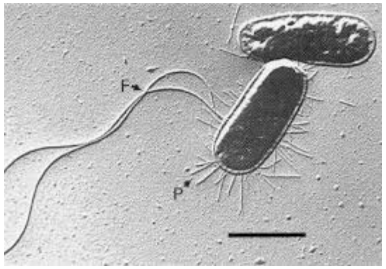
National swimming maps



How do we measure microbial water quality?

- **Faecal Indicator Organisms**

E. coli



- Historically:
- Total coliforms
- Faecal coliforms
- Faecal streptococci

Campy

- Currently:
- *Escherichia coli* – Freshwater
- Enterococci – Marine water

Different types of standards

- Different types of WQ standards – Complicated by grades and statistics

(A)	Primary contact standard “Swimmable” Head under the water	4 *Complicated* metrics Median, 95th percentile, % exceedance values for 260 and 550
(B)	Secondary contact standard “Wadeable” Fishing, boating	*Superseded*
(C)	Drinking standard	<1 *E. coli* $100mL^{-1}$
(D)	Shellfish harvesting Marine water	median <14 faecal coliforms $100mL^{-1}$
(E)	Marine Waters Swimmable Head under the water	< 280 *enterococci* $100mL^{-1}$

How do we set Water Quality Standards?

- **Freshwaters – Contact recreation**
- QMRA – Quantitative Microbial Risk Assessment
- Based on the relationship between *E. coli* and *Campylobacter* concentrations in New Zealand waters
- As the *E. coli* concentrations increase so do the risk of becoming infected by *Campylobacter*
- Give grading of low – medium – high risk
- At time of interaction with the water

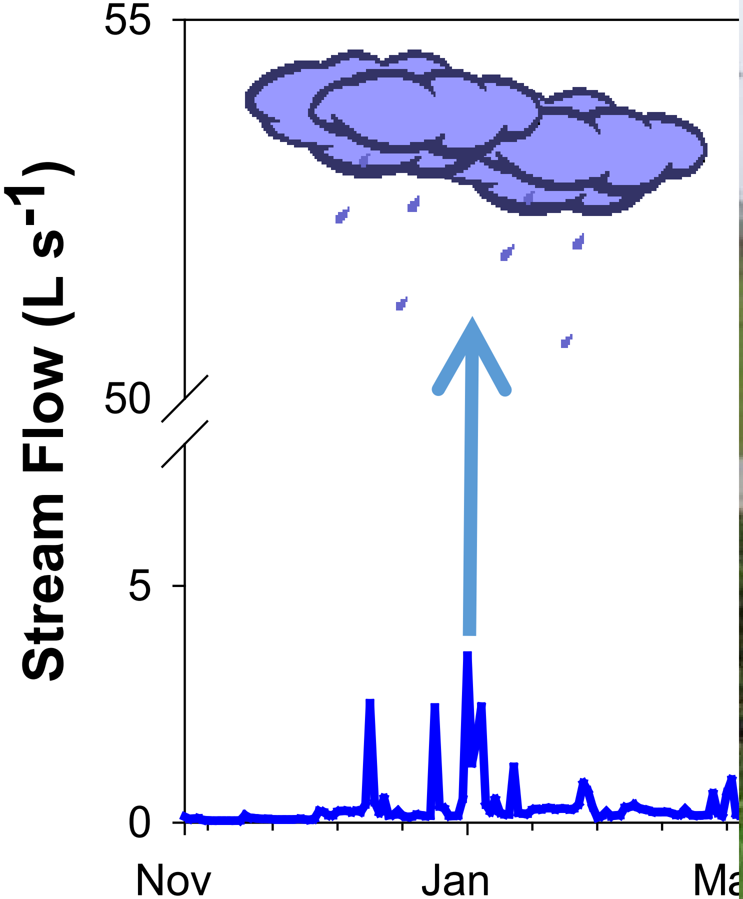
Table 9 – *Escherichia coli* (*E. coli*)

Value	**Human contact**			
Freshwater body type	Lakes and rivers			
Attribute unit	*E. coli*/100 mL (number of *E. coli* per hundred millilitres)			
Attribute band and description	**Numeric attribute state**			
Description of risk of *Campylobacter* infection (based on *E. coli* indicator)	% exceedances over 540/100 mL	% exceedances over 260/100 mL	Median concentration /100 mL	95th percentile of *E. coli*/100 mL
A (Blue) For at least half the time, the estimated risk is <1 in 1,000 (0.1% risk). The predicted average infection risk is 1%.	<5%	<20%	≤130	≤540
B (Green) For at least half the time, the estimated risk is <1 in 1,000 (0.1% risk). The predicted average infection risk is 2%.	5-10%	20-30%	≤130	≤1000
C (Yellow) For at least half the time, the estimated risk is <1 in 1,000 (0.1% risk). The predicted average infection risk is 3%.	10-20%	20-34%	≤130	≤1200
D (Orange) 20-30% of the time the estimated risk is ≥50 in 1,000 (>5% risk). The predicted average infection risk is >3%.	20-30%	>34%	>130	>1200
E (Red) For more than 30% of the time the estimated risk is ≥50 in 1,000 (>5% risk). The predicted average infection risk is >7%.	>30%	>50%	>260	>1200

What can we do about Microbial wq?

- A complication with stream flow

Storm vs Base-Flow



Annual yields

Flow	Water Yield	DRP	NO_3	*E. coli*
Storm-flow	33 %	51 %	22 %	92 %
Base-flow	67 %	49 %	78 %	8 %

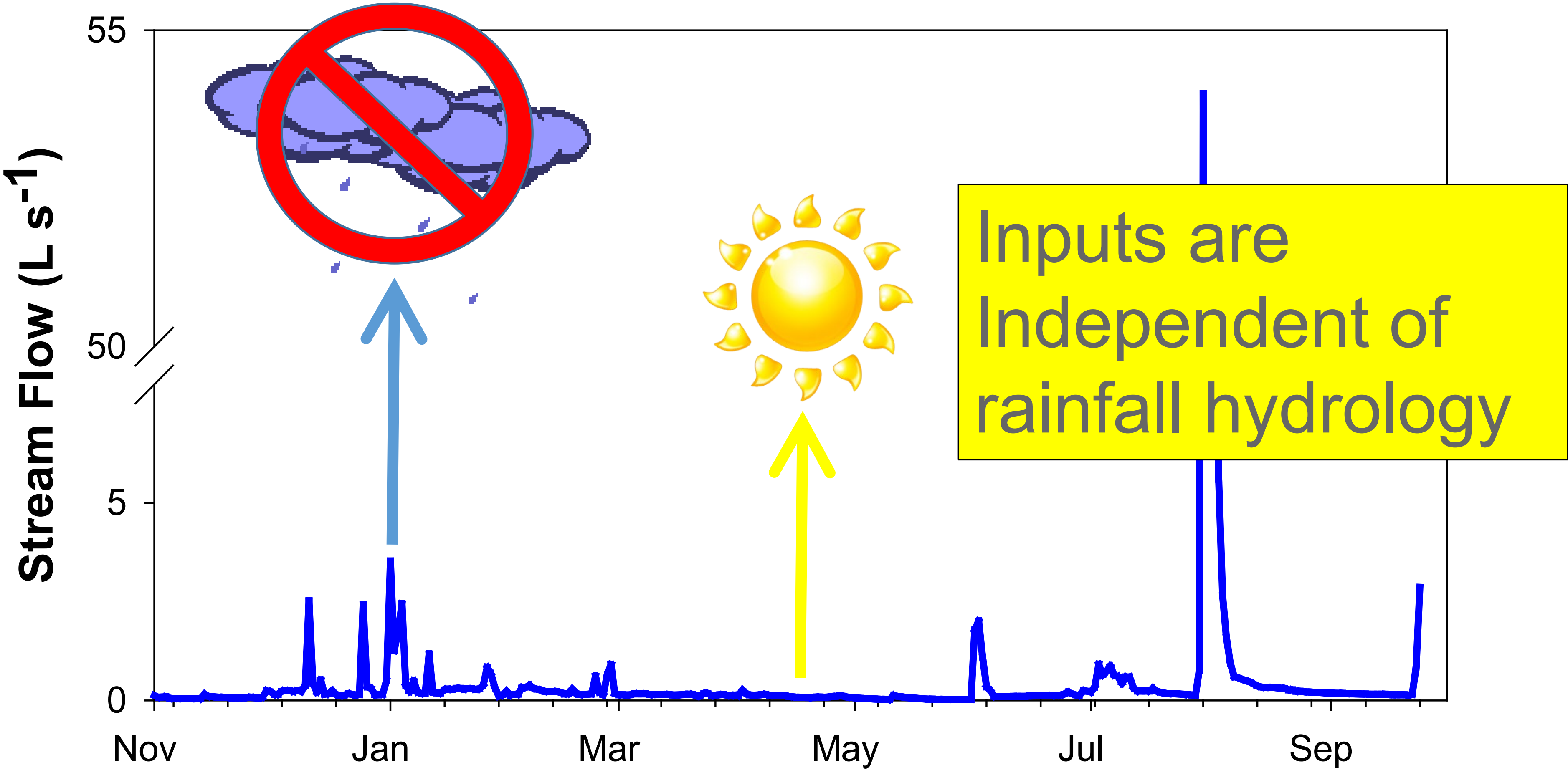
- DJ Ballantine and RJ Davies-Colley (2013) Nitrogen, phosphorus and *E. coli* loads in the Sherry River, New Zealand. New Zealand Journal of Marine and Freshwater Research 47(4): 529-547

Need to target mitigations - depending on the stream values you want to protect

- Storm-flow impacts on the receiving water body
- Lake
- Estuary
- Reservoir
- Drinking water takes
- Marine bathing beaches

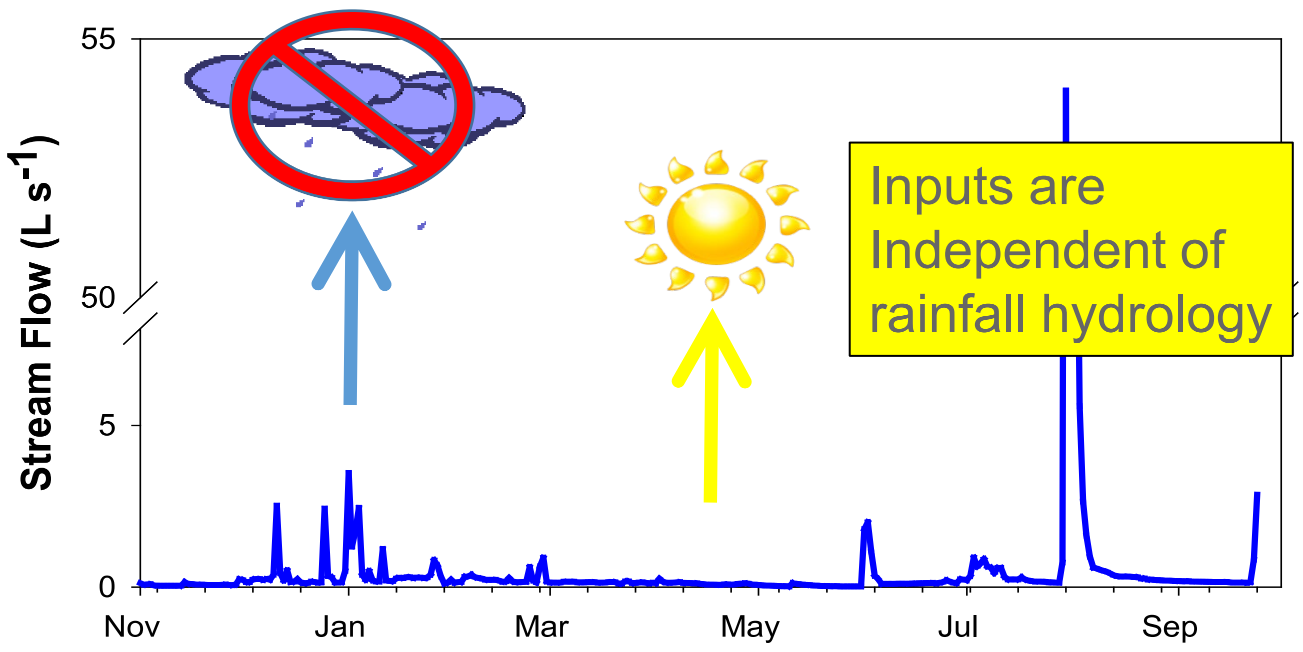
- Really don’t have any quantifiable mitigations
-
- My research has focused on base-flow conditions

Storm vs Base-Flow

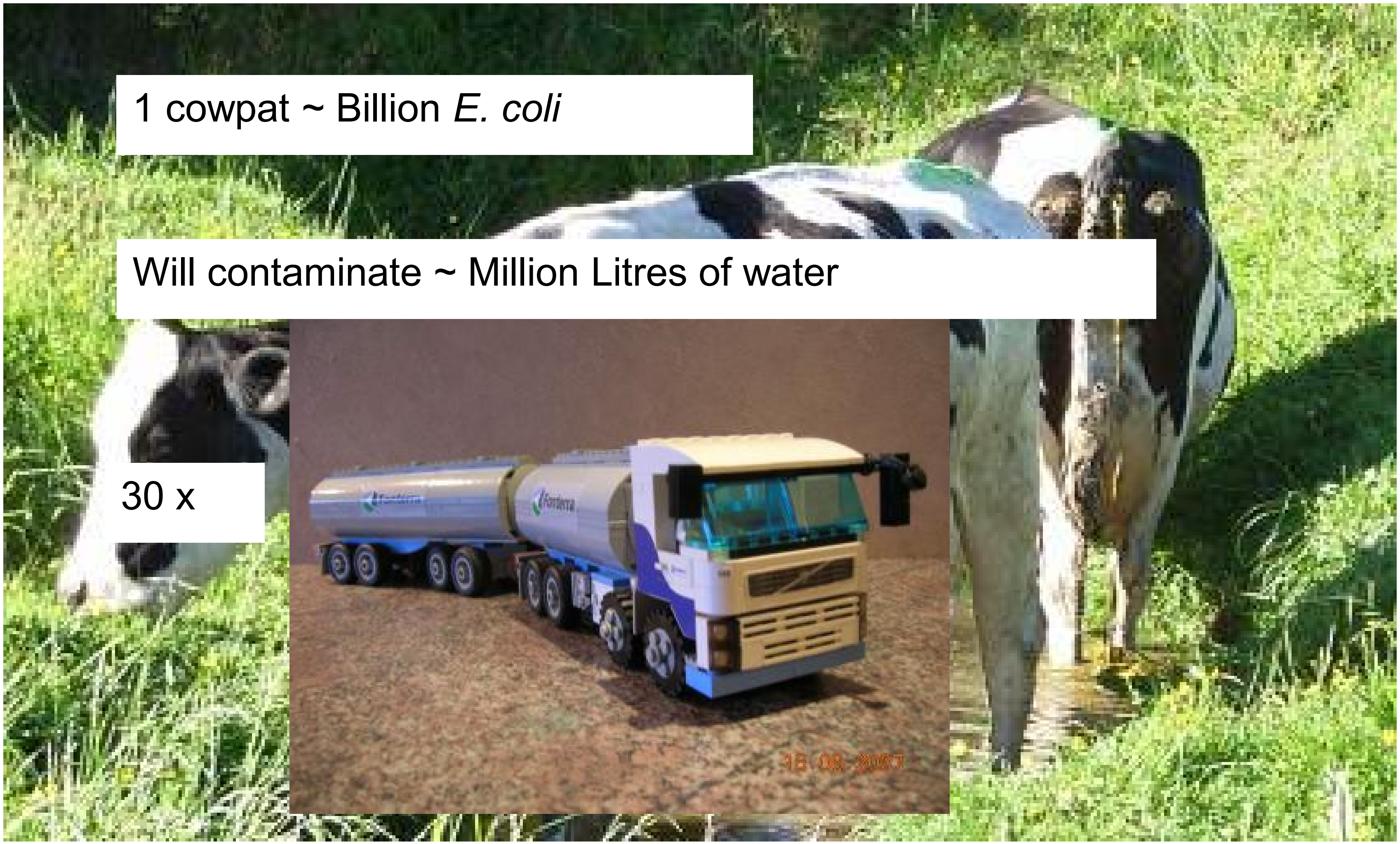


Key inputs and mitigations for base-flow

- Direct inputs from animals
- Stream crossings
- FDE management
- Irrigation



Sources: Direct deposition



Direct Faecal Inputs

Bad

Good

Faecal source tracking in Southland

Faecal Source Investigations in Selected Southland Waterways

Marta Rusinol

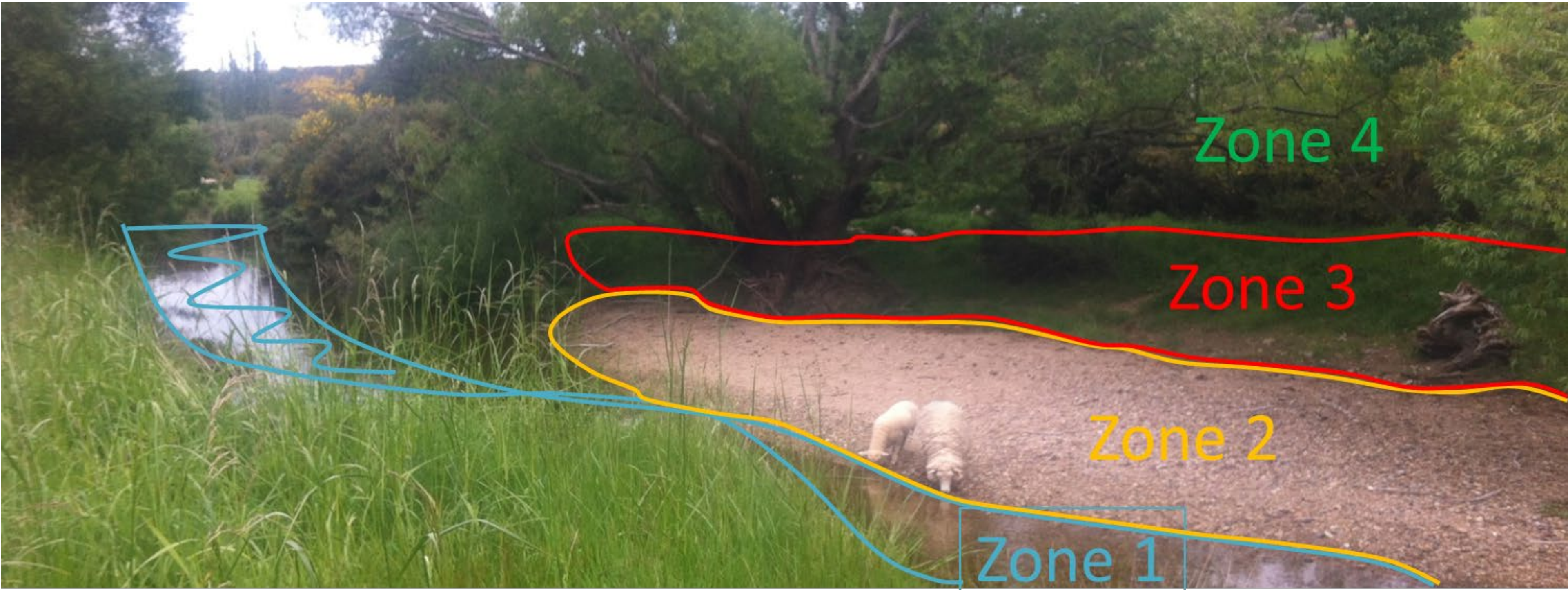
Dr Elaine Moriarty

ESR

- Found cow markers in dairying areas
- Found sheep markers in all samples!

Sheep impact on water

- Sheep excrete high concentrations of *E. coli* in faeces
- Sheep spend **less** time in the water than cows
- Sheep spend time in the stream channels



Effluent Management Systems

1

2

3

4

e. Coli Summary

- Human health risk
- *E. coli* as a faecal indicator
- Animals are a source of risk
- Based on NZ data
- Fencing and FDE management
- Ross will talk about runoff mitigations

Managing landscapes to protect water quality

Ross Monaghan

Ethical Agriculture Group

AgResearch

Invermay

Mosgiel

agresearch

āta mātai, mātai whetū

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āta mātai, mātai whetū

Outline

1. Winter grazing
2. Managing pasture landscapes
   - ➢Wet soil management
   - ➢The importance of wetlands
3. Mitigation triage?

Winter grazing pressure and vulnerability

Pressure:
5 – 20 m^2/cow/day

Vulnerability:

No plant uptake of N

Surplus rain likely

↓ soil cover, porosity

↑ soil erodibility

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Winter grazing & surface erosion

Soil damage + nil ground cover =

⬆ Overland flow =

⬆ Surface erosion

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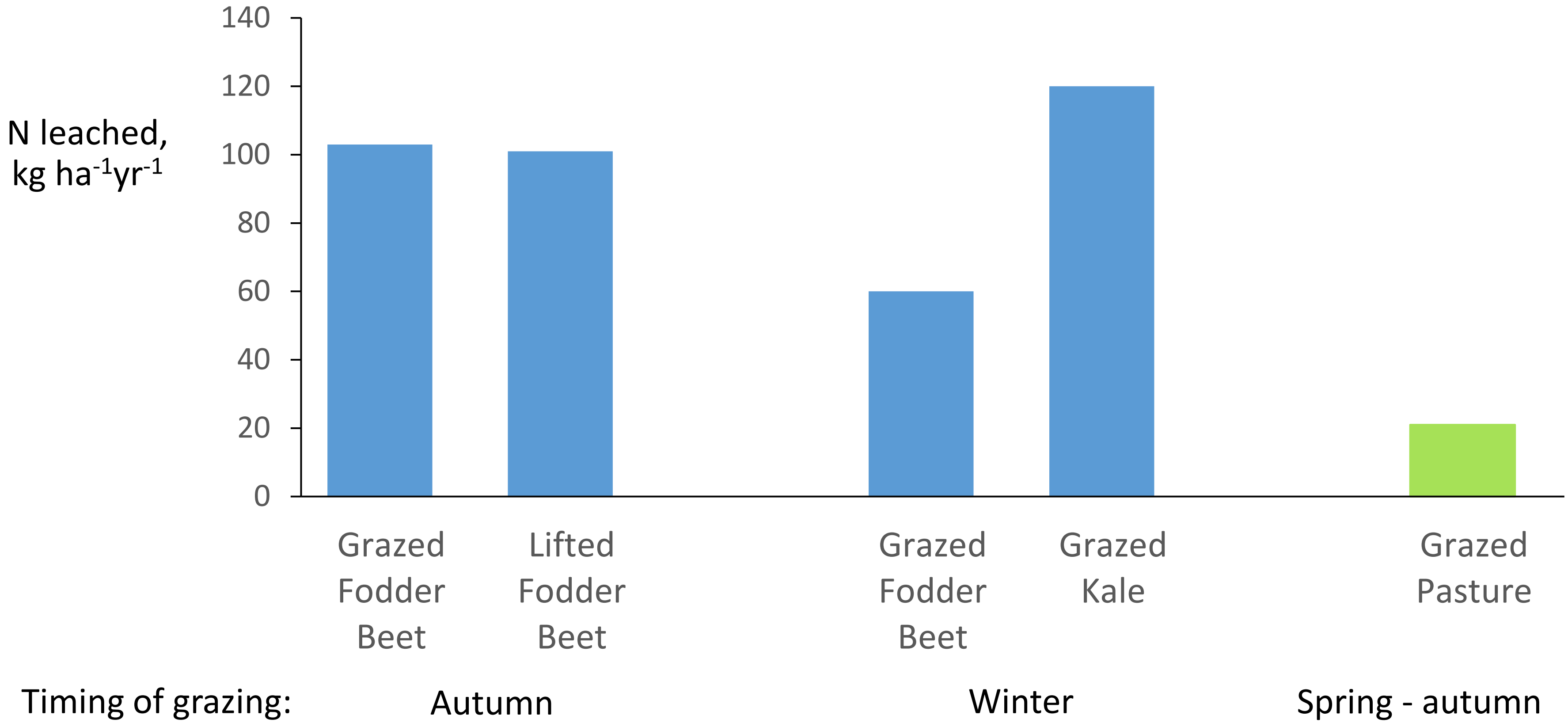
N losses to water

Crops and pasture at the Southern Dairy Hub (SDH)



Smith & Monaghan, 2020

Sediment runoff is well managed

Floodplains = High Risk = avoid if possible…

Hay bale wintering

Bare ground estimates using drone footage: winter runoff paddocks @ end Sept

Ground cover:

36% bare

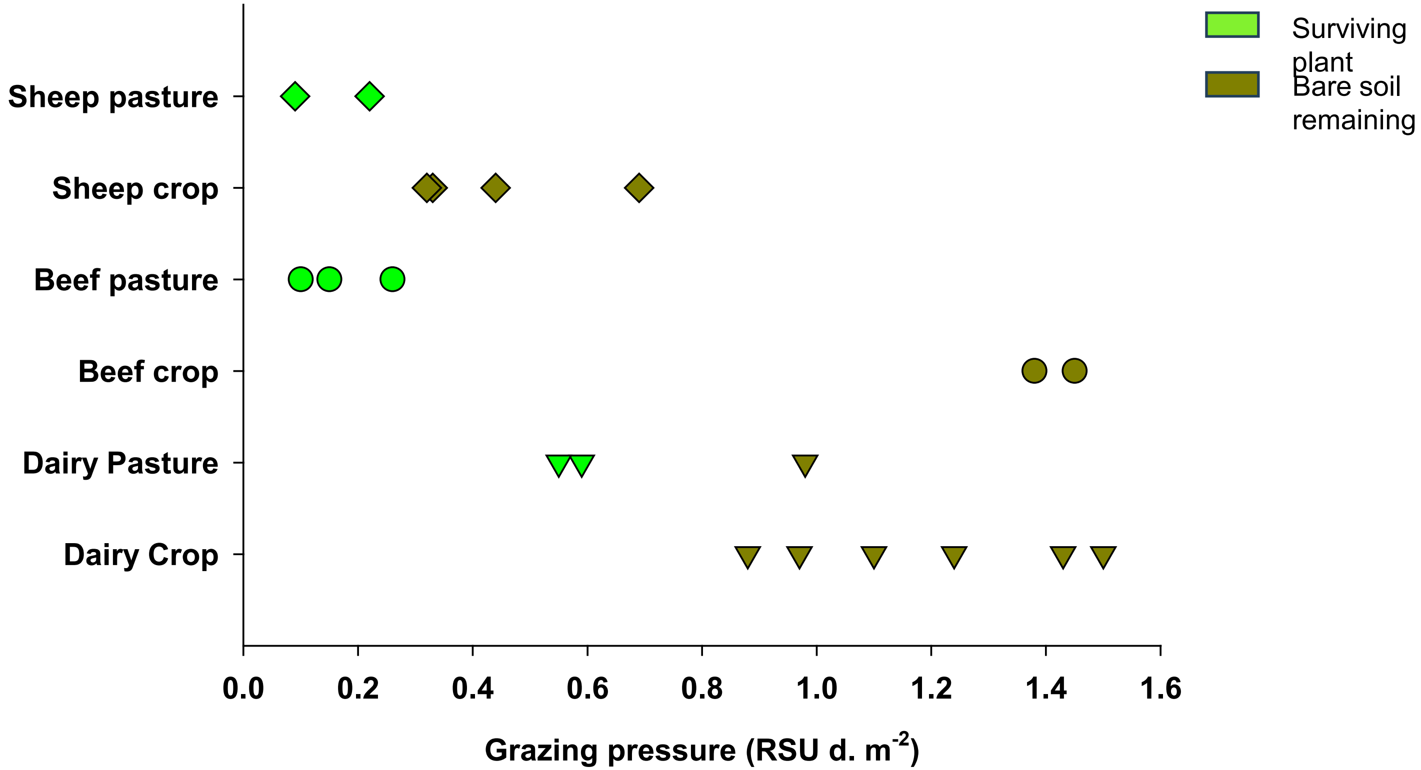
48% green

13% bale residue

Reduced soil loss risk

Catch "crop"?
- hay bale wintering, mid October

Winter grazing pressures and plant survival:



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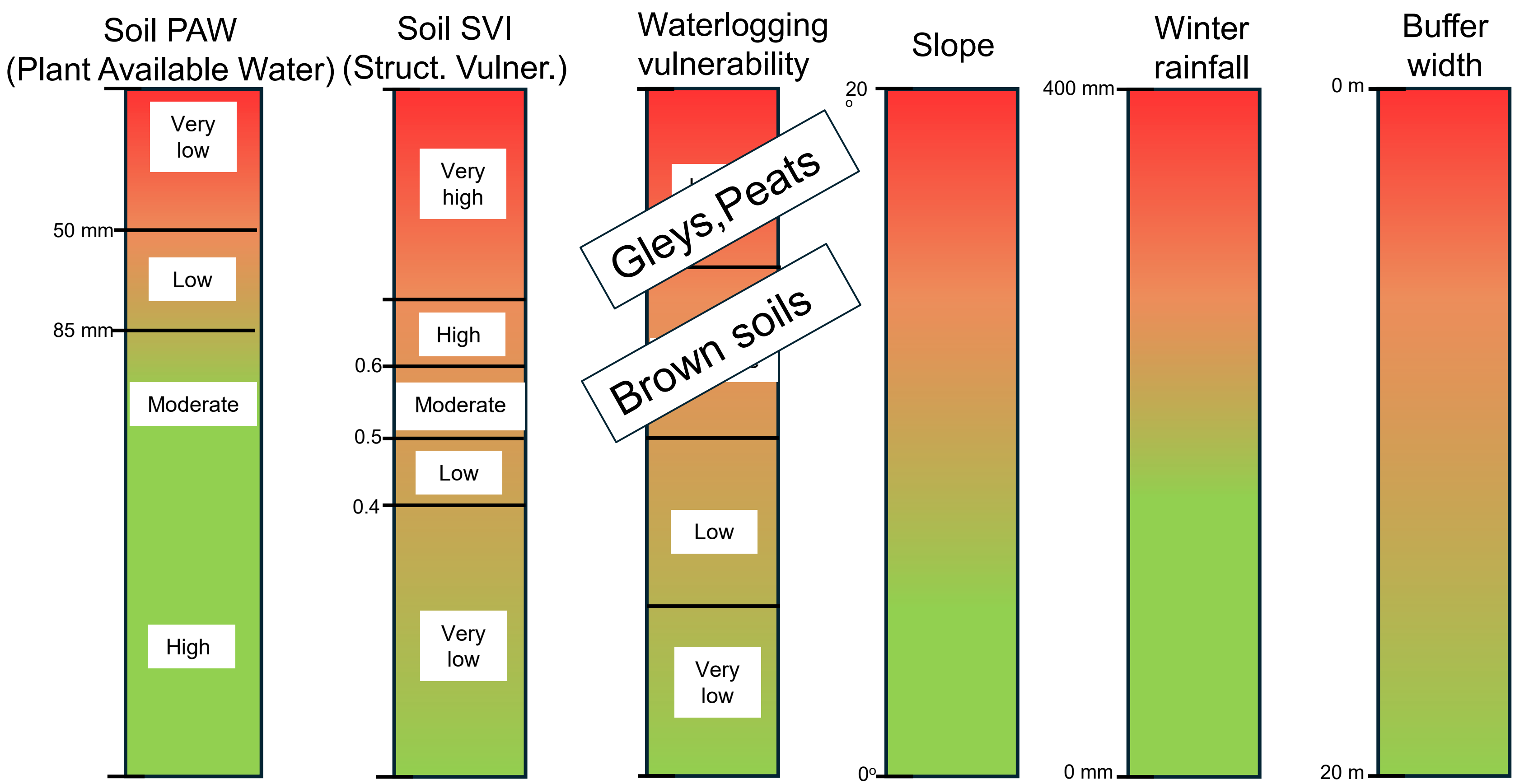
Buffer protections

Buffer protections

Landscape vulnerability factors: an integrated framework



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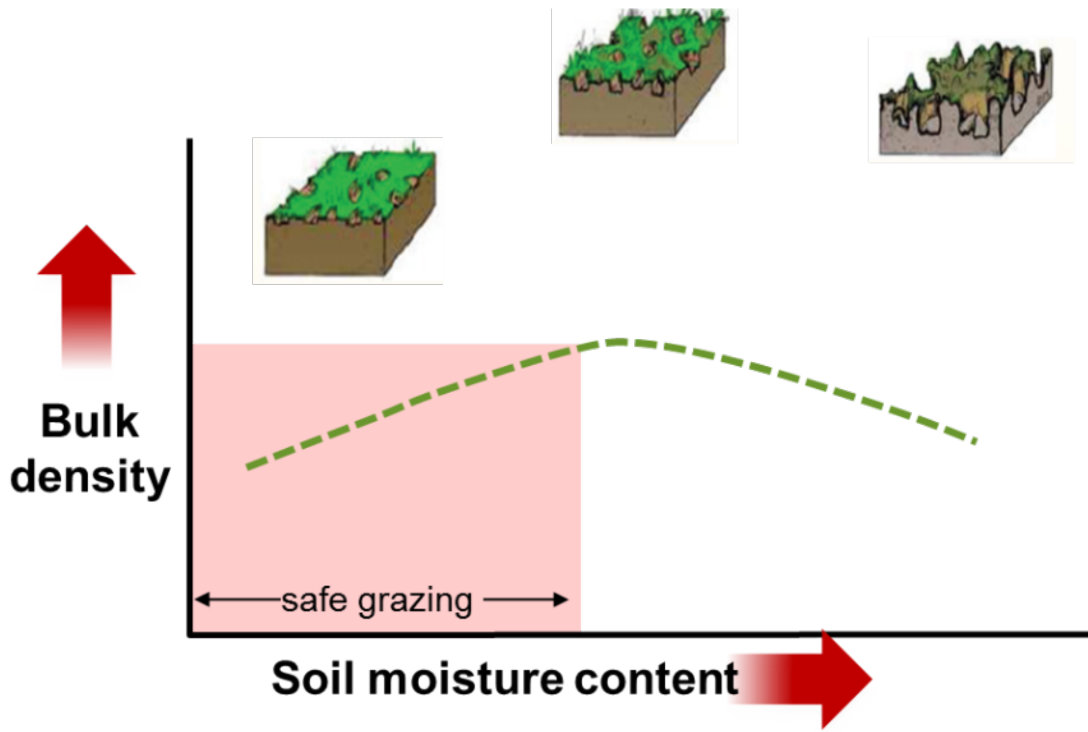
Fundamental Research
- treading damage to soils



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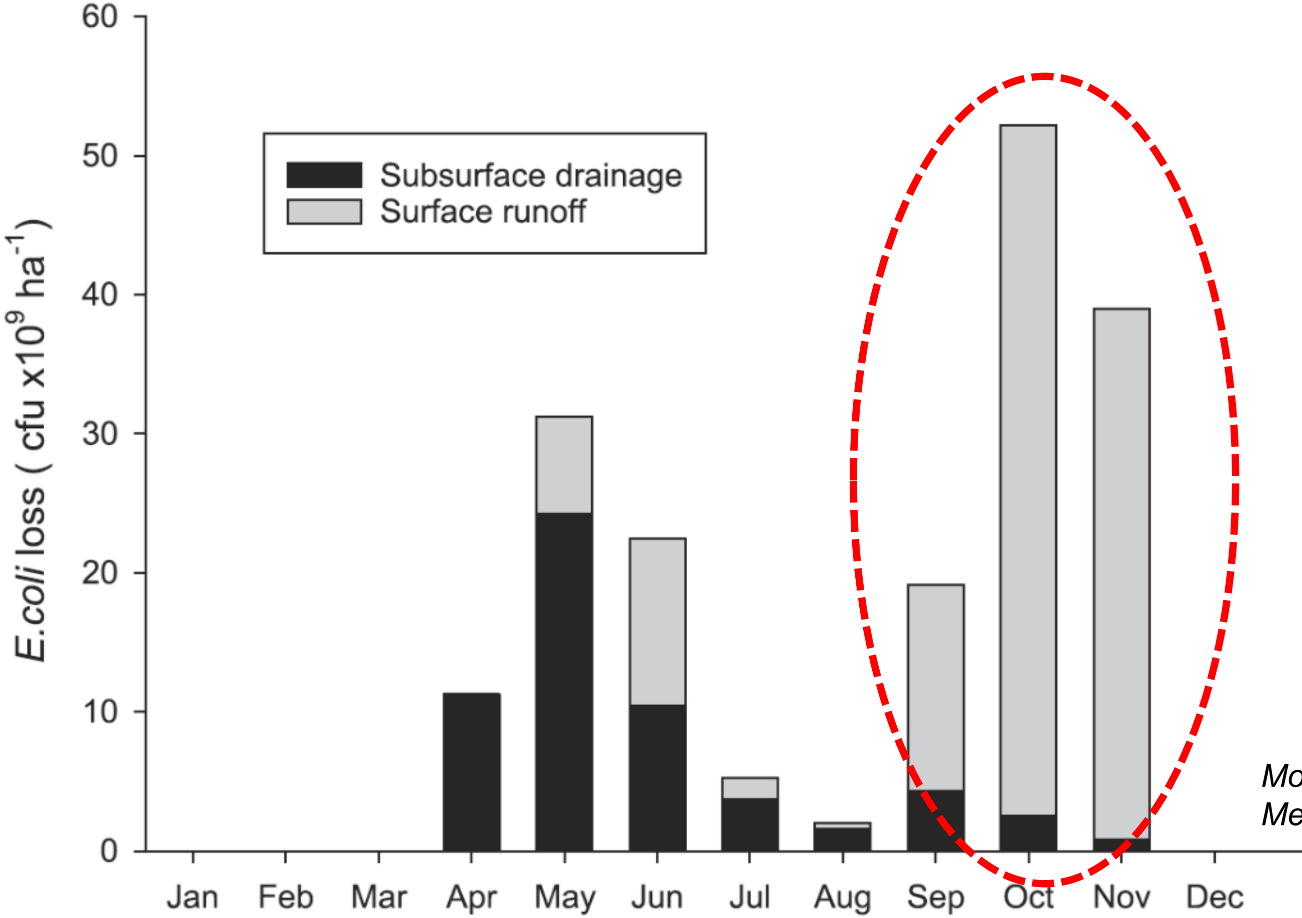
Soil treading damage at Tussock Creek: Losses of faecal bacteria (and sediment & P) to water



Monaghan et al. 2016 AEE
Mean fluxes over 3 years

Suggested triage

Flat, well-drained land	Sloping terrain Poorly-drained or weakly structured soils
Good fertility and riparian management	
Lower N feed	Edge of field buffers
Catch crops	Strategic grazing to protect Critical Source Areas
Soil armouring - possibly with hay or straw - reduced tillage intensity	Avoiding floodplains and steeper slopes
Off-paddock?	(then as for well-drained land)

Off-paddock infrastructure?

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Off-paddock infrastructure?

Suggested triage - ctd

Flat, well-drained land	Sloping terrain Poorly-drained or weakly structured soils
Wetlands	
Plantain	
Tracks and lanes sited away from streams & lane runoff diverted to land	

Wetlands

Wetland attenuation:

≈ 30% N reduction
provided all water can be intercepted

(sediment & *E. coli* reductions)

(McKergow et al. 2008)


Not just a dairy problem…


What contingency plans are others using?

- Budgeting 10% extra feed
- Increasing area available
  - New break or behind the back fence
- Saving drier, lower risk crop paddocks on the farm with shelter
- Saving sheltered areas within a paddock for grazing later
- Yards/laneways with rubber matting for short periods
- Feed-pads/stand-off pads
- Safe tree blocks if available
- Grass strips in crop pdks

DairyNZ

What contingency plans are others using?

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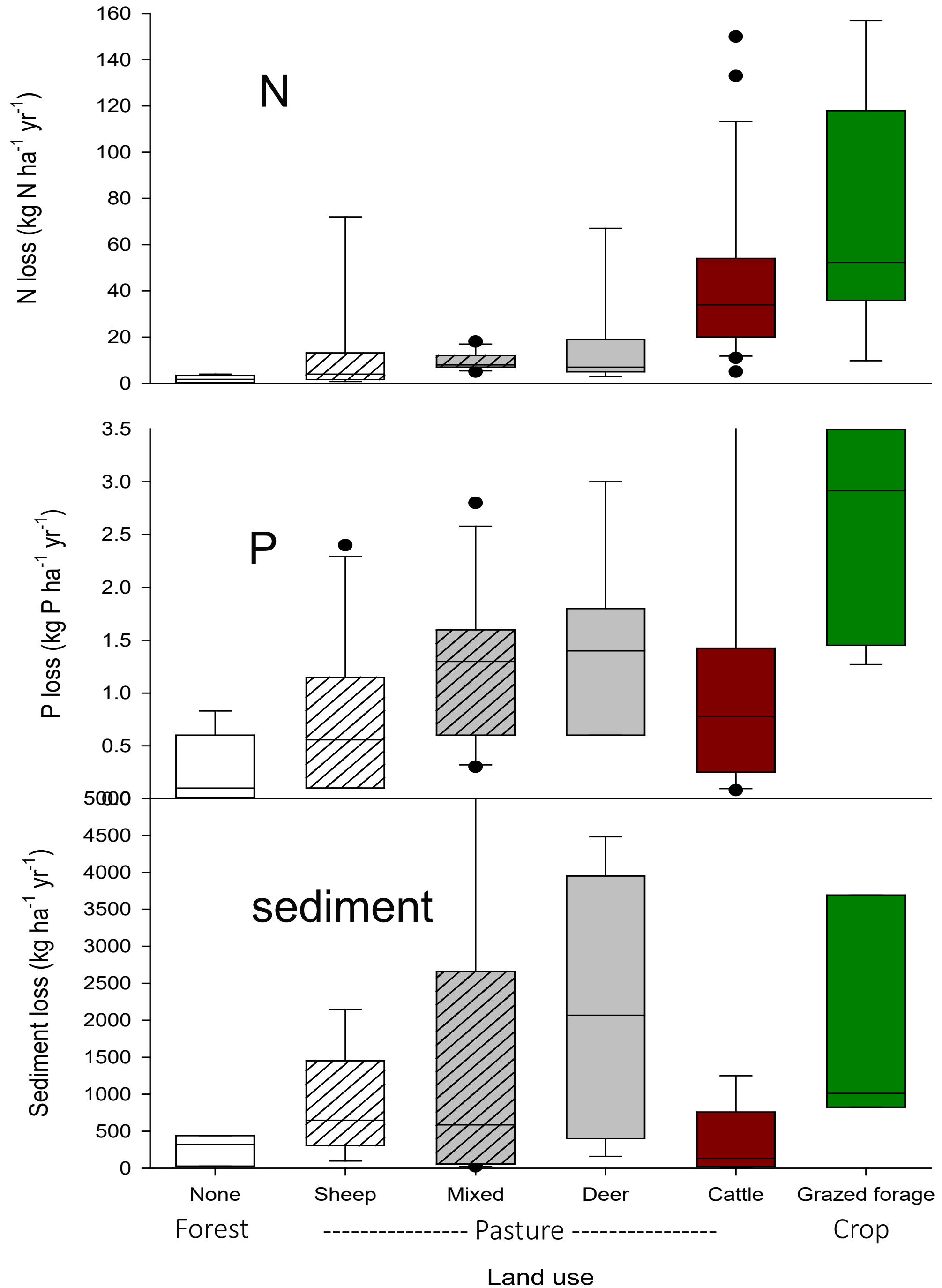
- Feed-pads/stand-off pads
- Safe tree blocks if available
- Grass strips in crop pdks

Literature review: what is typical? (on a per ha basis)

(1970-present)

Wide range due to:
climate
soil type
topography
management



Why prevent sediment runoff?

CLARITY

DESCRIPTION When standing in knee-deep water, the bed is easily and clearly seen.