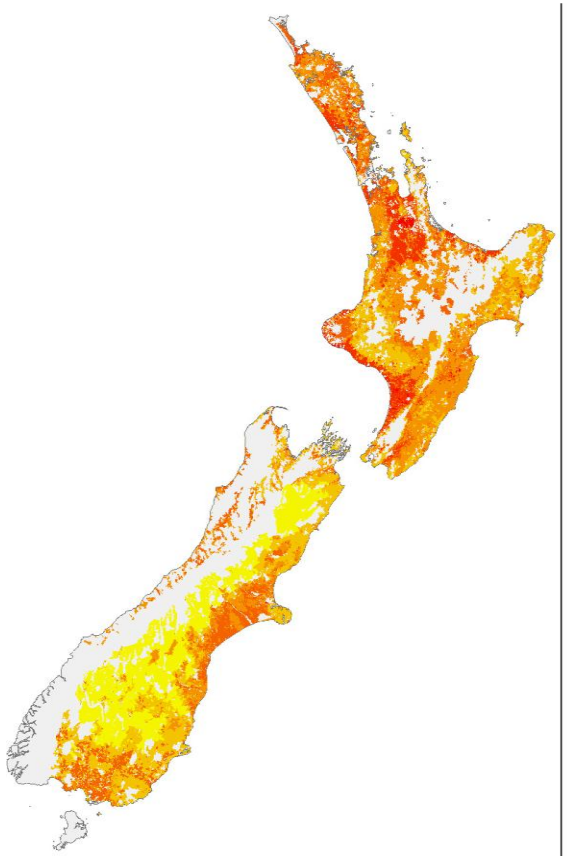
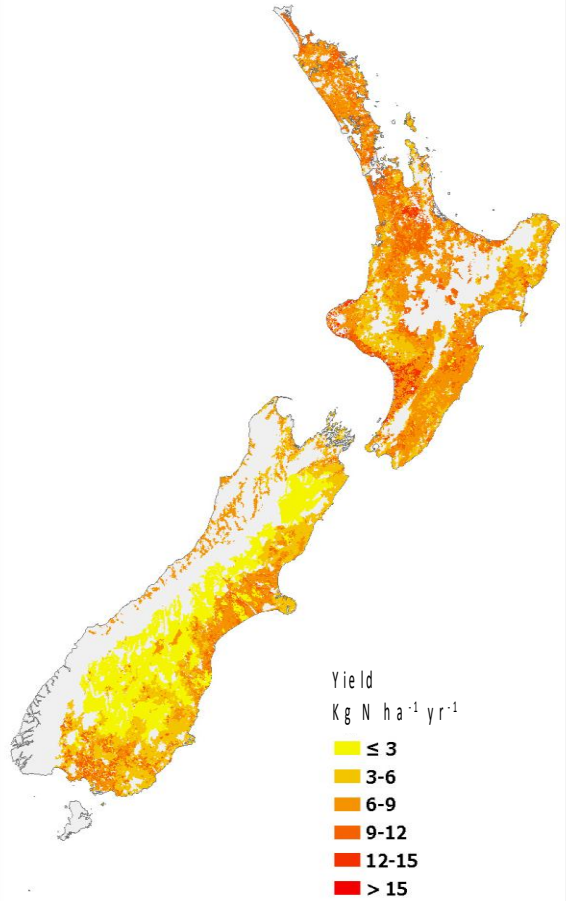
New Zealand’s approach to improving water quality in agricultural catchments

Is it possible to improve water quality to the desired state?

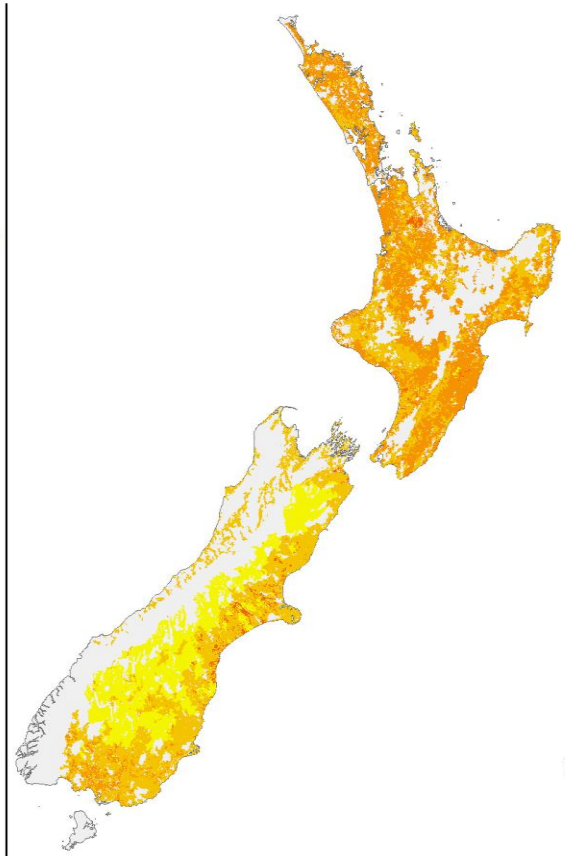
Current



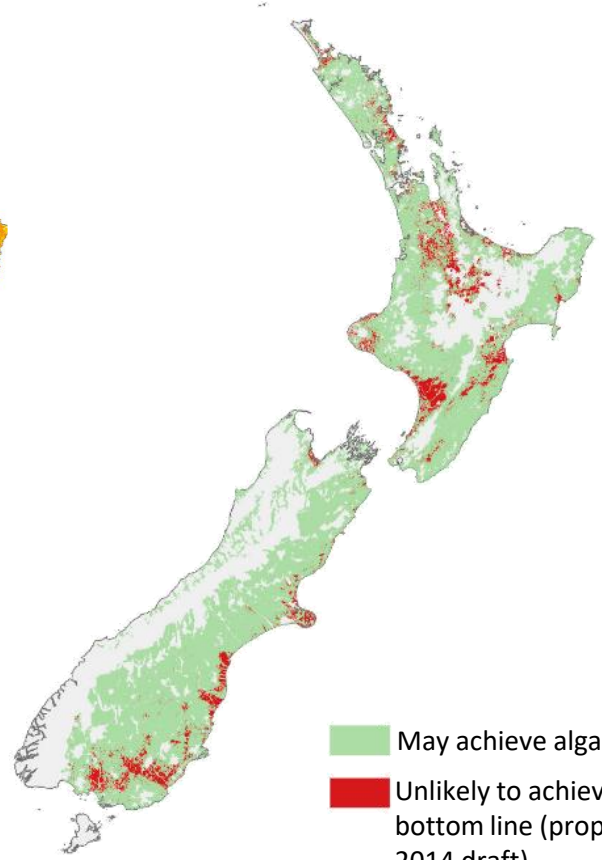
Established measures



Established + developing



= Not low enough



N	P	N	P
19% ↓	24% ↓	34% ↓	36% ↓

Current policy settings (TBC soon)

Mandatory farm plans apply to:

- 20 hectares or more in arable or pastoral use
- 5 hectares in horticultural use
- 20 hectares or more of combined use.

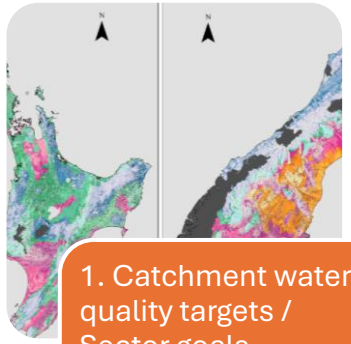
Risk of freshwater contamination identified along with remedial actions tailored to each farm based on:

- the farm landscape
- farming activities
- and the local catchment.

Freshwater farm plans to be certified and audited and reported to their regional council.

Farmers and Sector bodies

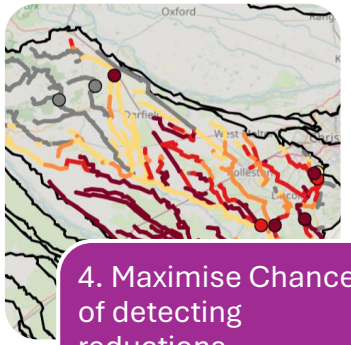
Catchment groups and Councils



1. Catchment water quality targets / Sector goals
   - Regulations for catchment.
   - Percentage improvement

2. Select farm actions
   - Consider suitability to enterprise, cost-effectiveness, speed, co-benefits and limitations.

3. Plan and implement actions
   - Optimise placement of actions to 'leaky' parts of the farm.
   - Determine percentage reduction.



4. Maximise Chance of detecting reductions
   - Determine where reductions would be best detected.

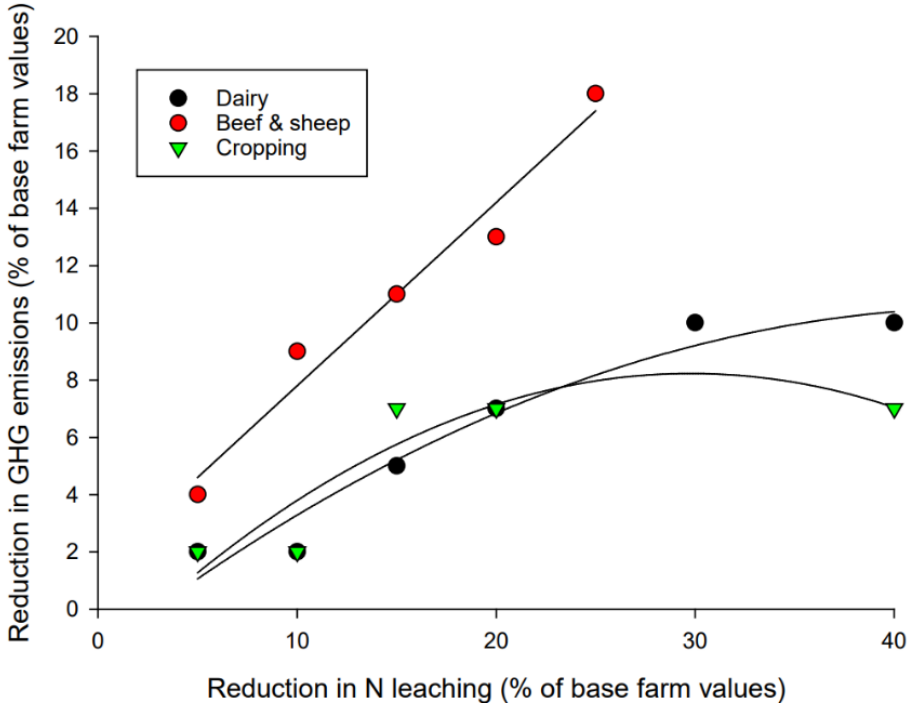
5. Attribute improvements to actions
   - Remove climate variation, lag-times, and changes in production.
   - Determine when improvements should be seen.

Evidence to encourage more action or better implementation

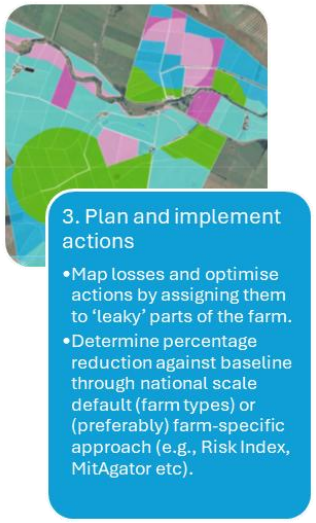
STEP 2: Select farm actions

2. Select farm actions
- Gather data on farm-performance.
- Suitability to contaminant(s) of interest and enterprise.
- Consider cost-effectiveness, speed, co-benefits and limitations.

1. Applicability
2. Placement and timing
3. Co-benefits
4. Duration
5. Cost-effectiveness
6. Unintended consequences and trade-offs

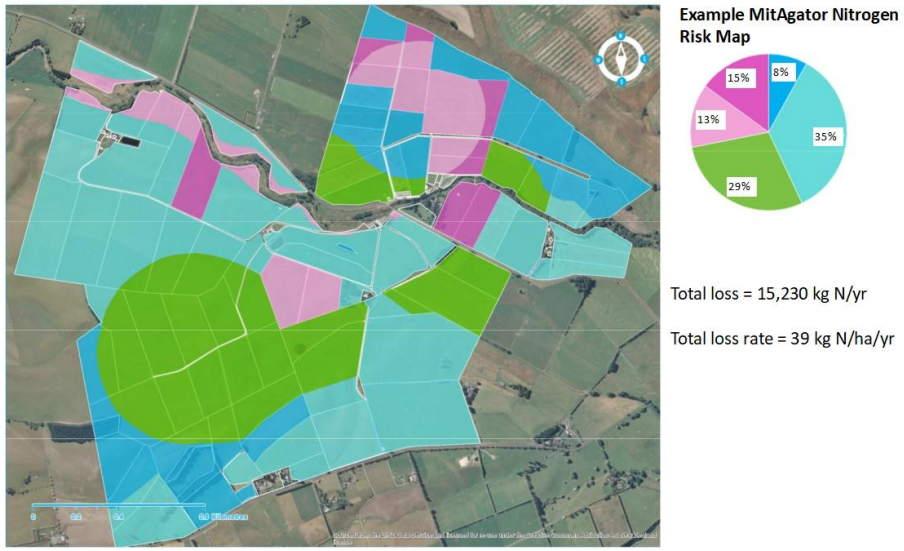


STEP 3: Plan and implement actions



1. Farm map of inherent risks
2. Implement appropriate actions, focusing on critical source areas, leading to 6-7 times improvement in cost-effectiveness (but possibly less after accounting for existing uptake of actions).

Critical source areas only		Whole catchment	
ΔEBIT	ΔContaminant loss	ΔEBIT	ΔContaminant loss
-2%	-40%	-12%	-48%

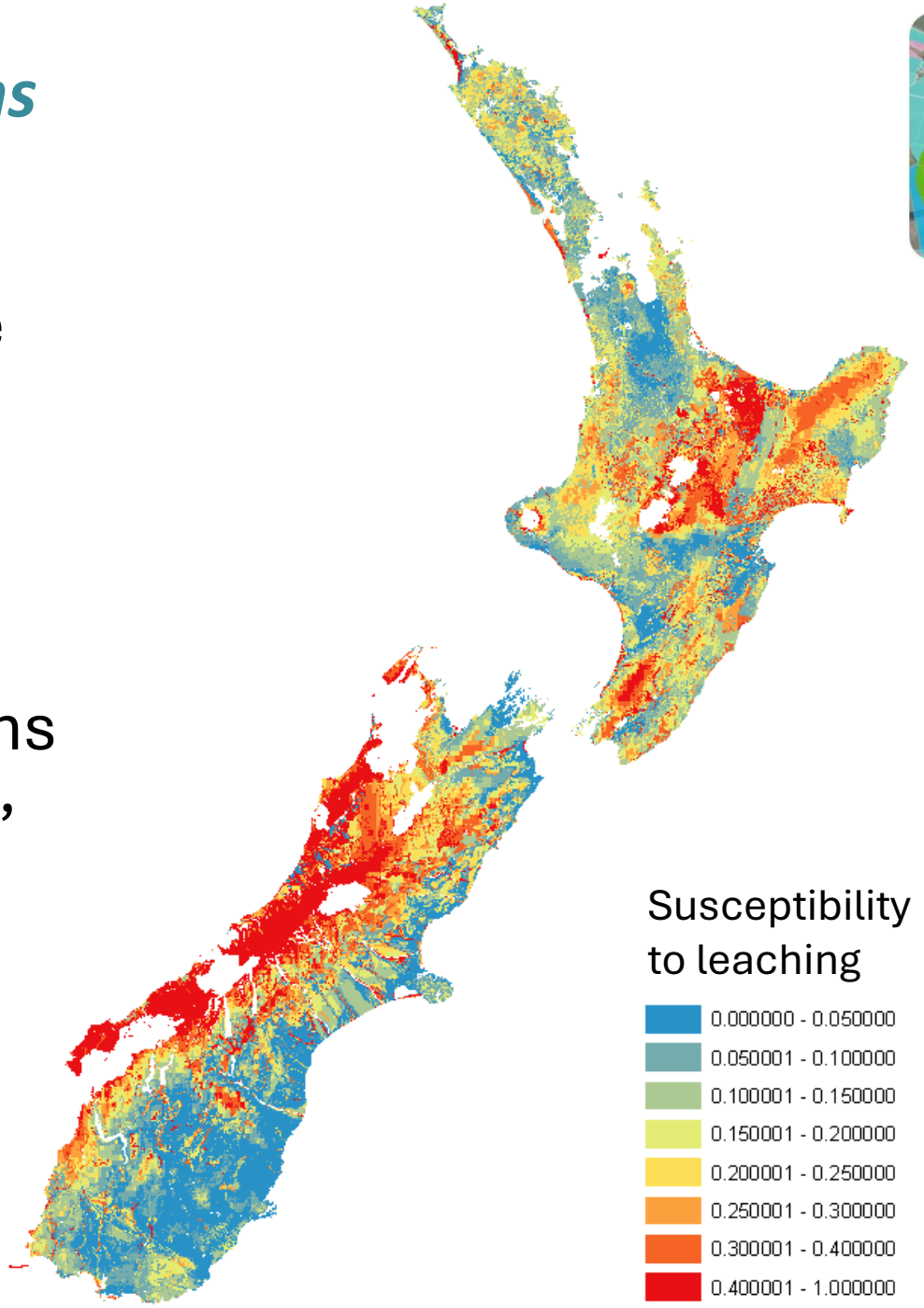


STEP 3: Plan and implement actions

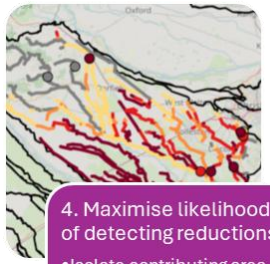
3. Actions and their effect must be **measurable, transferrable (and auditable).**
4. Farm plans tools must match actions to the risk of loss. Actions beyond ‘good farming practices’ may be needed to meet targets.

3. Plan and implement actions

- Map losses and optimise actions by assigning them to ‘leaky’ parts of the farm.
- Determine percentage reduction against baseline through national scale default (farm types) or (preferably) farm-specific approach (e.g., Risk Index, MitAgator etc).

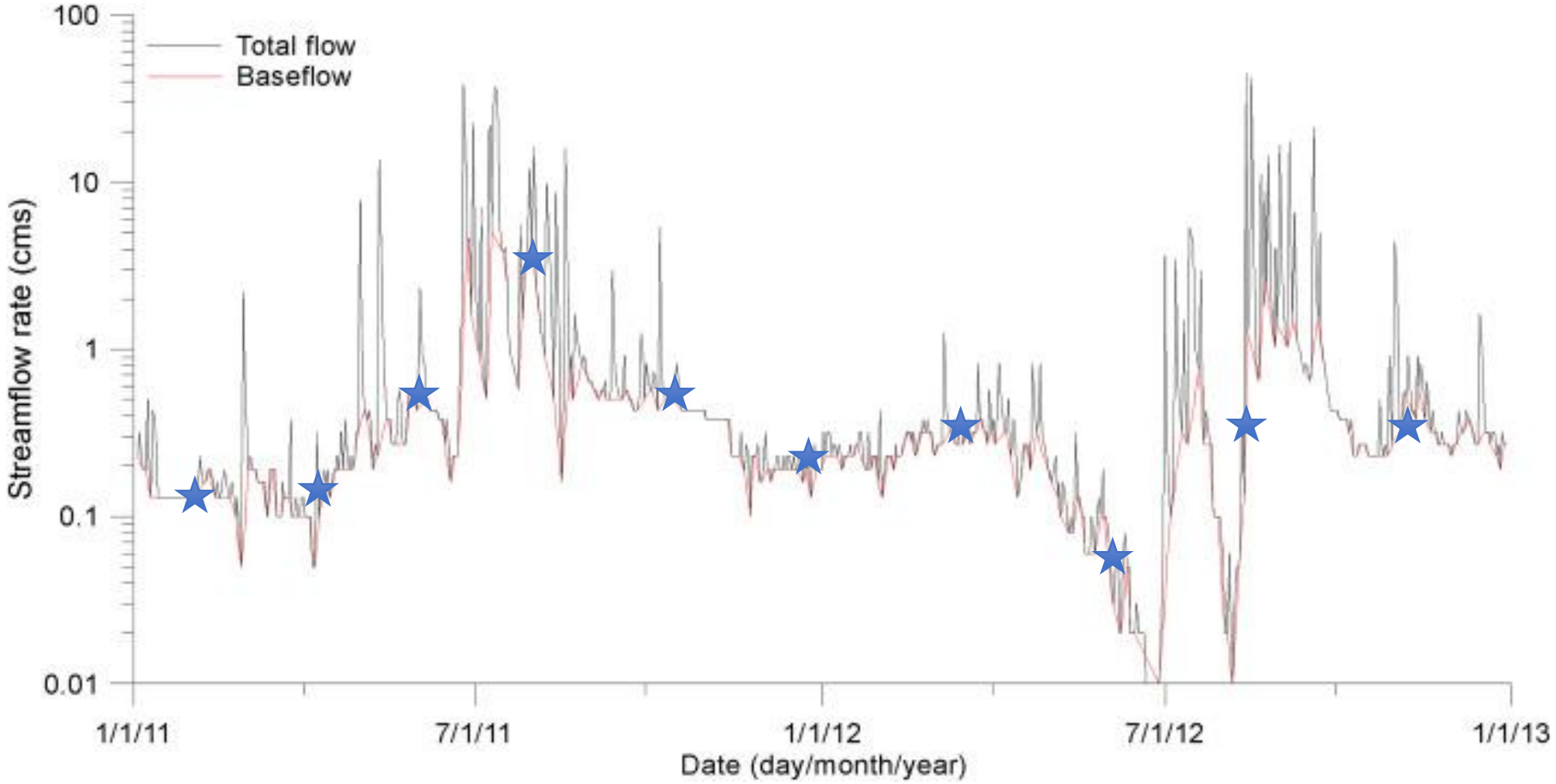


STEP 4: Maximise likelihood of detecting reductions



4. Maximise likelihood of detecting reductions

- Isolate contributing area
- Determine where reductions would be best detected.
- Account for lag times between implementation and site of measurement.
- Fit-for-purpose monitoring time and frequency.



STEP 4: Maximise likelihood of detecting reductions

Average number of samples needed to detect policy targets across ~1000 sites

River analyte	Samples per year (5 years)	Samples per year (20 years)
Nitrate-N	17	15
E. coli	80	45

To detect changes:

1. Take more samples,
2. Change targets,
3. **Take more samples at sites that are sensitive to land management actions**

www.monitoringfreshwater.co.nz

Nitrate nitrogen

(3b) Select sampling duration (years):

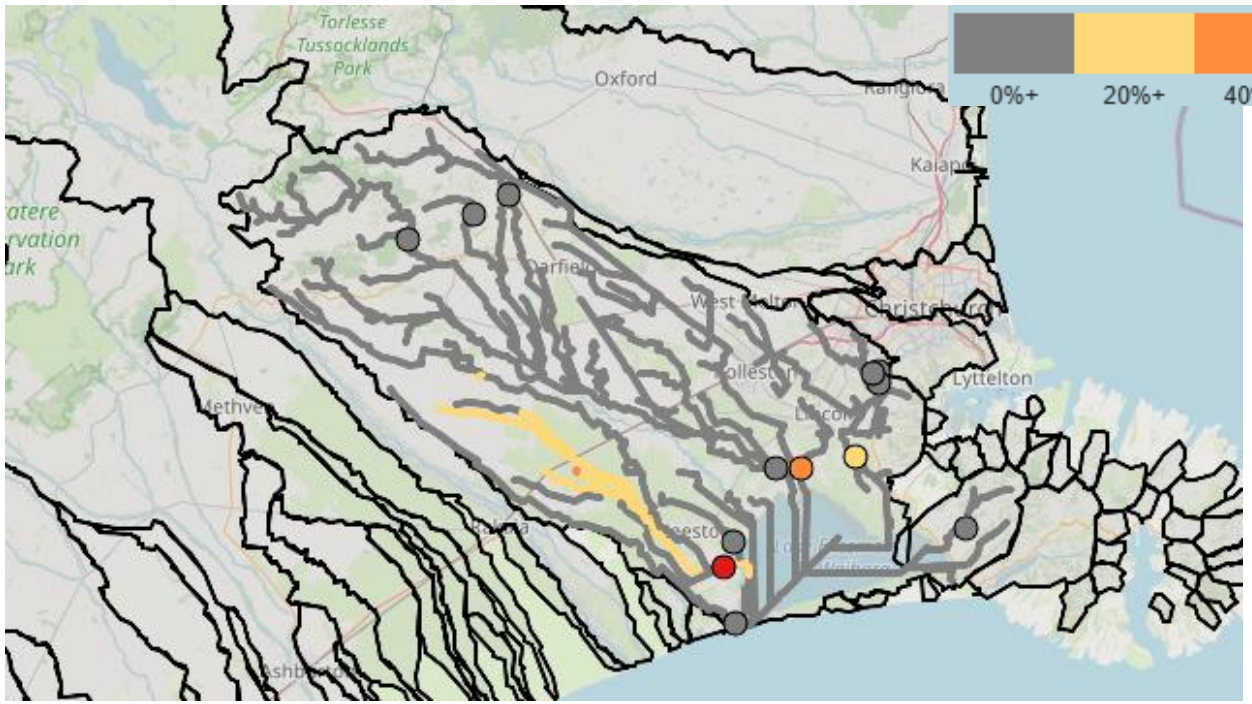
5 | 10 | 20 | 30

(3c) Select sampling frequency:

quarterly | **monthly** | fortnightly | weekly | biweekly | daily

(3d) Select the percentage of the maximum contaminant loss reductions applied (❓):

0% 20% 40% 60% 80% 100%



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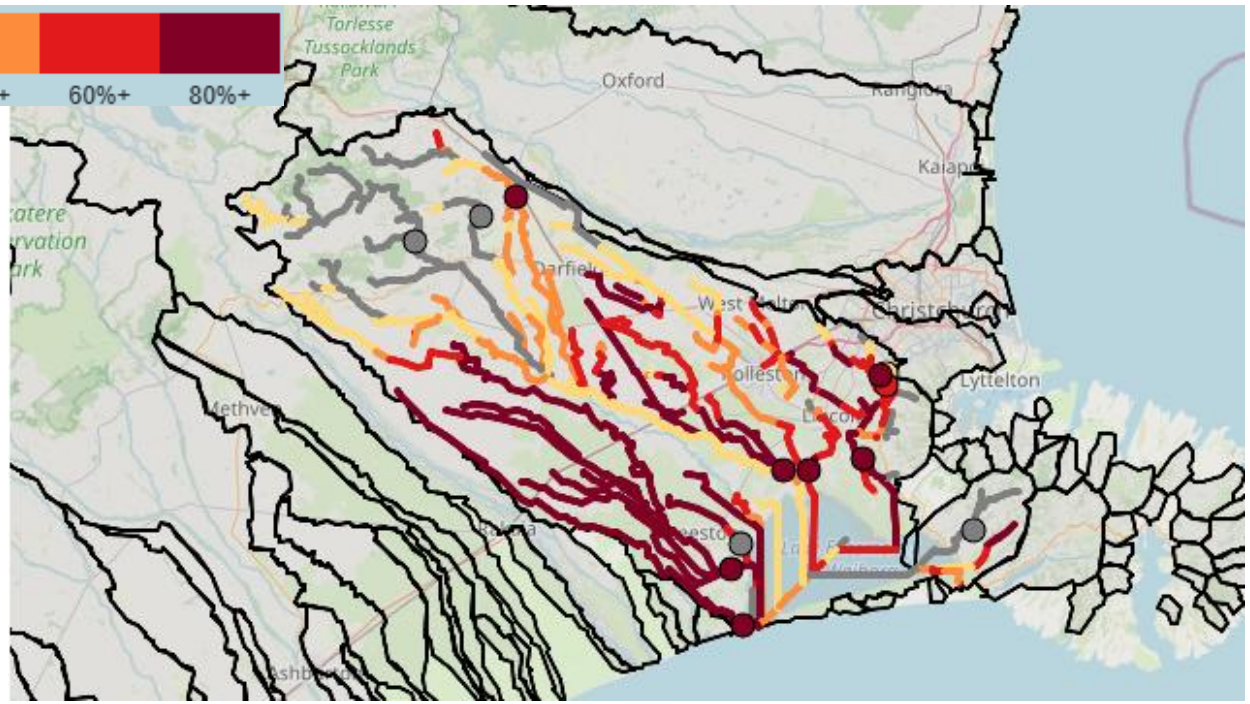
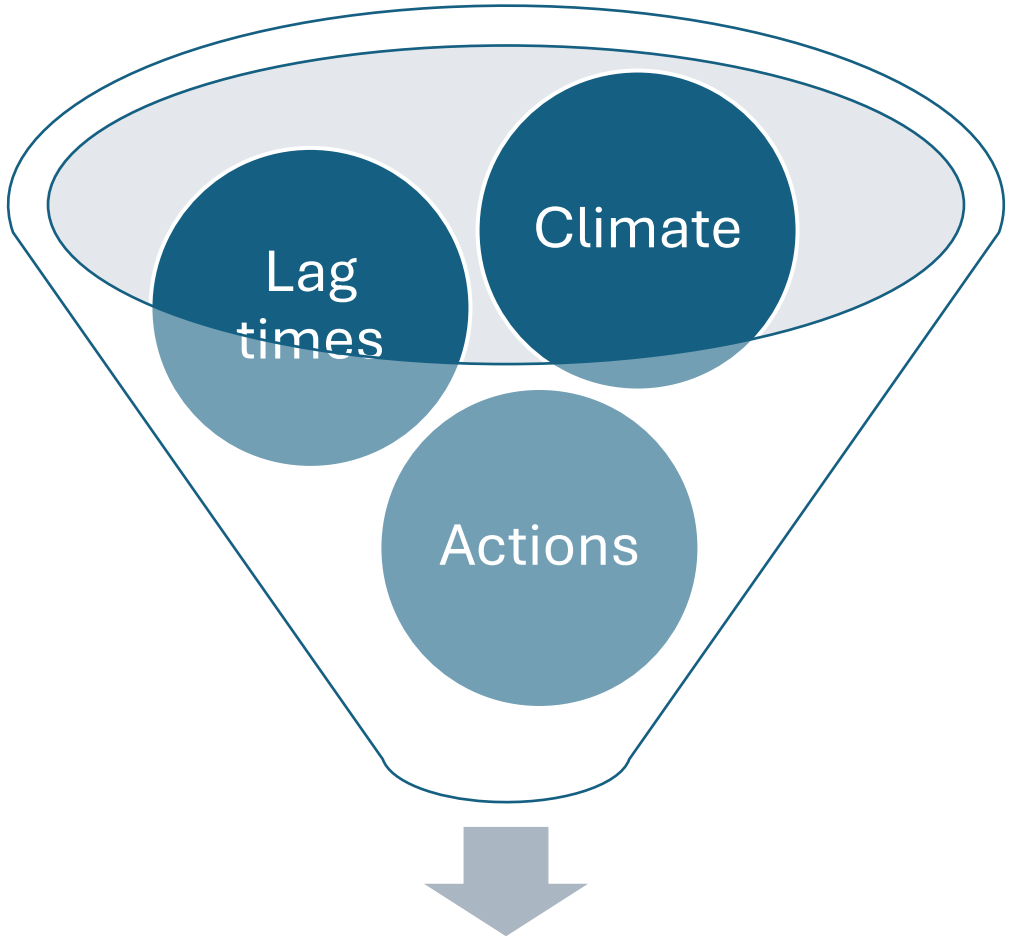


STEP 5: Attribution of improvements to actions

5. Attribution of improvements to actions

- Determine when improving trends should be seen (i.e. with lag times).
- Account for the influence of production and climate (may not be necessary for catchments with short-lag times and where effective actions were implemented widely and abruptly).



Attribution

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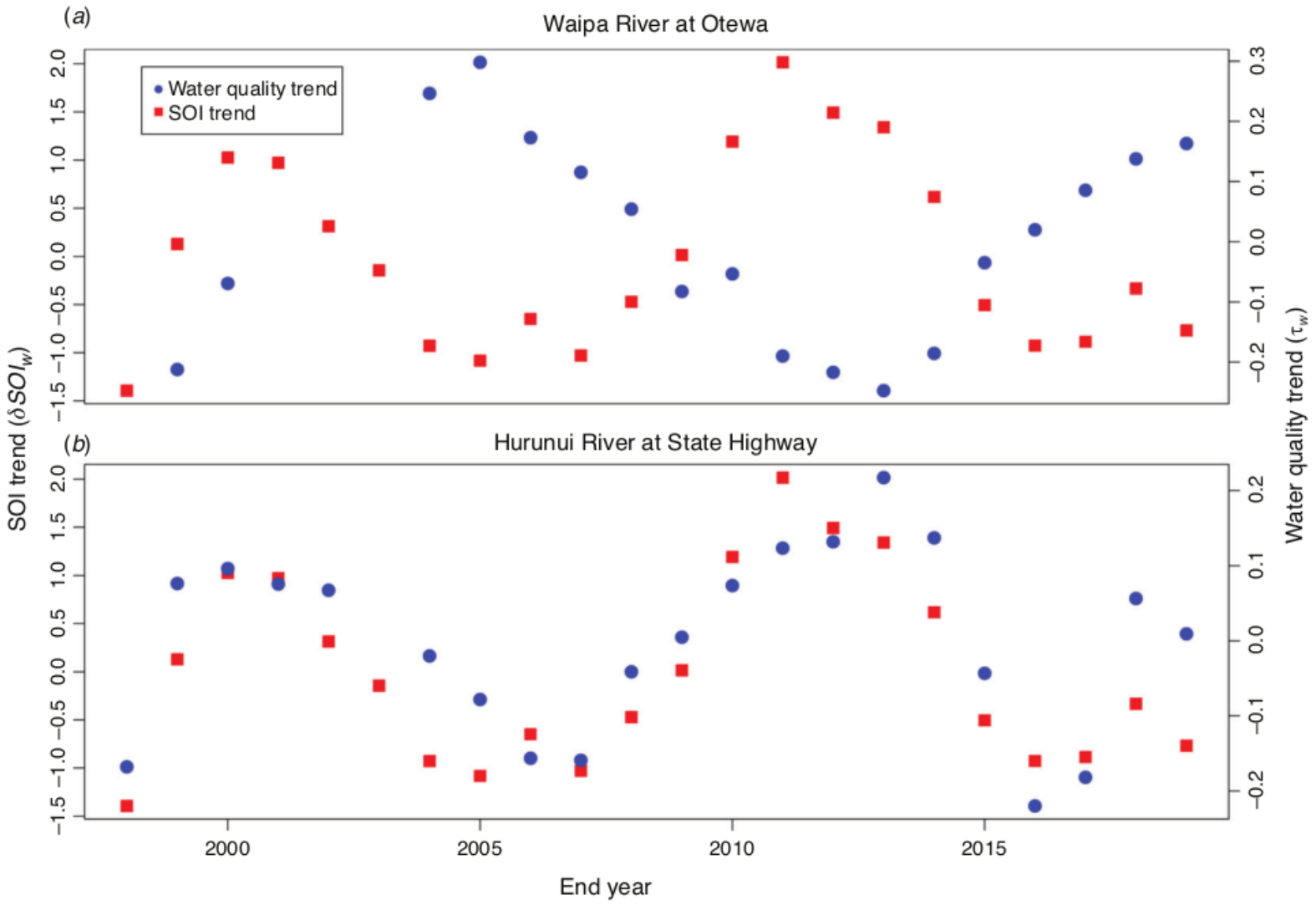

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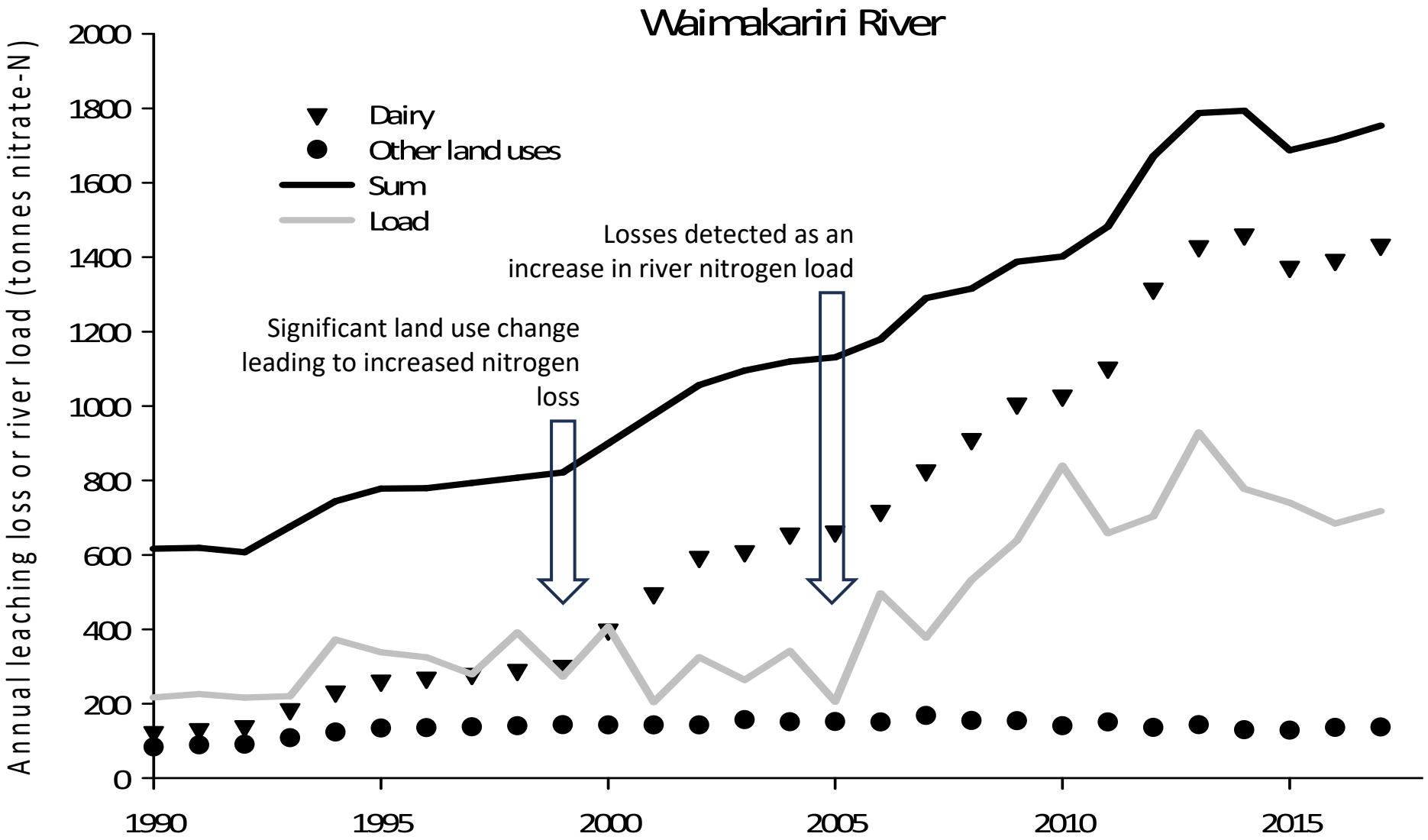
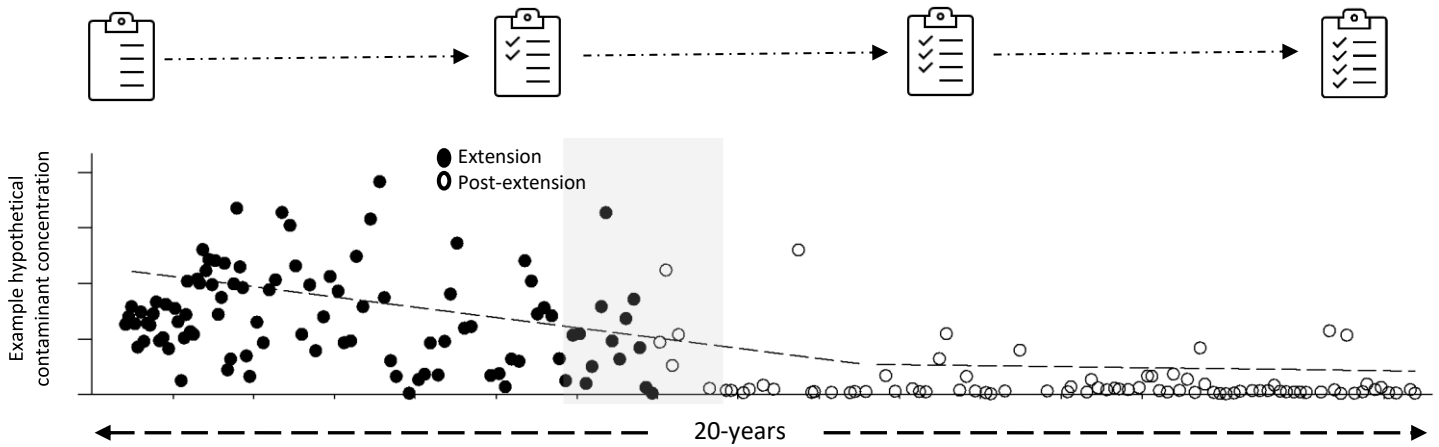


Average lag times in large catchments is **4.5** years

Farm plans quickly improve surface water quality

Uptake of dairy sector "**Best Management Practices**"

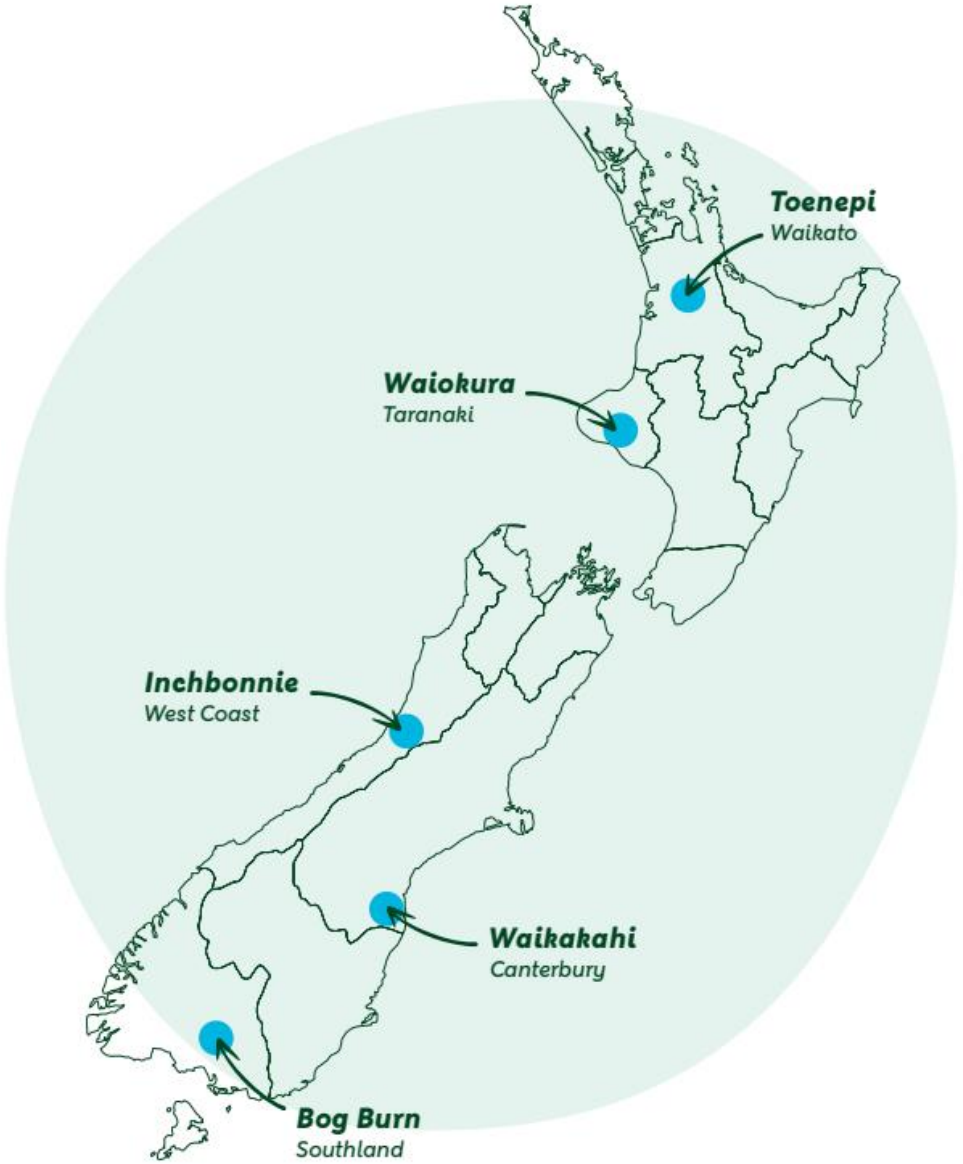


"Extension"

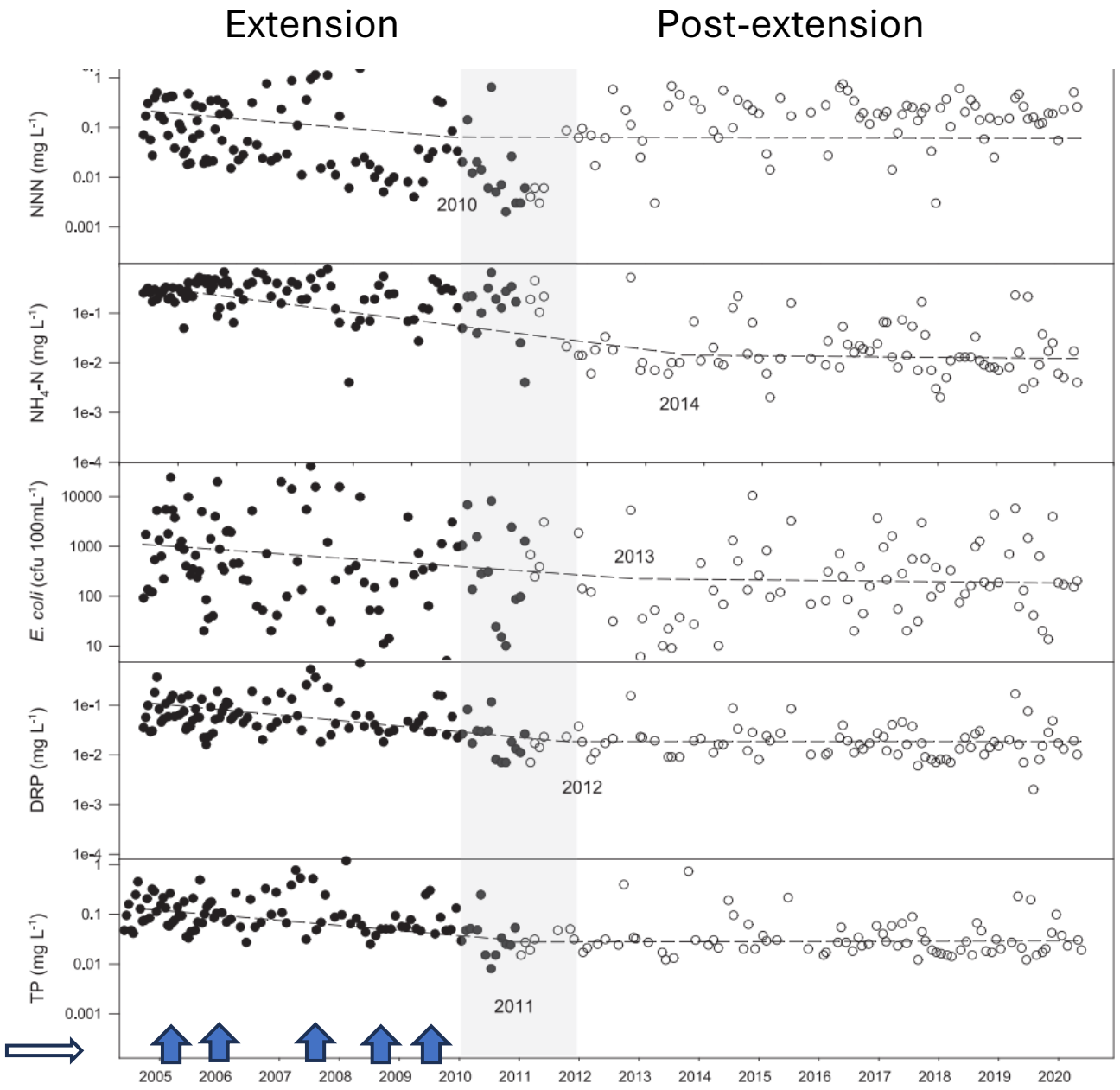
- Farmer engagement
- Knowledge exchange
- Practice change
- Water quality

"Post-extension"

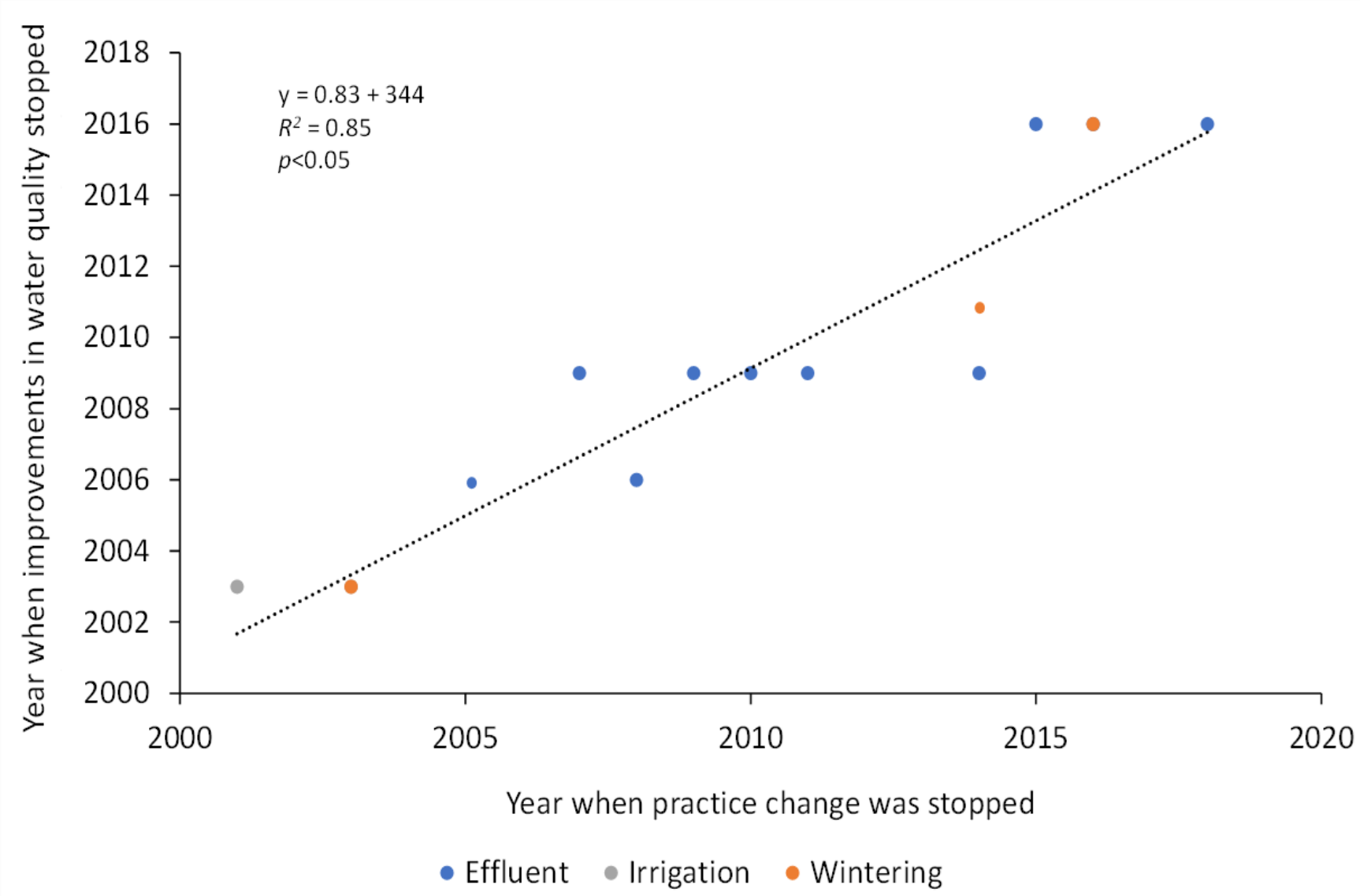
- Practice change
- Water quality



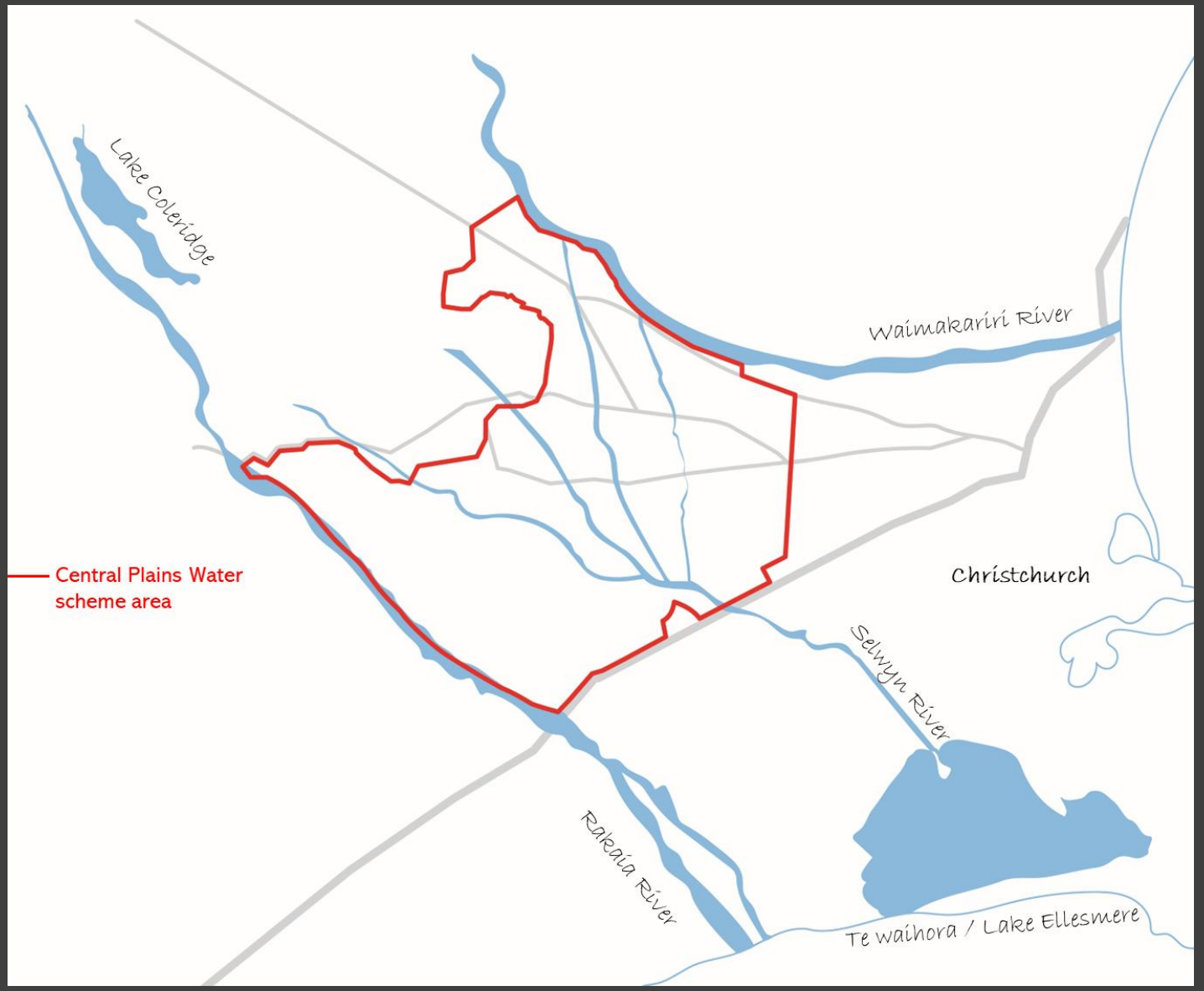
When mitigation was implemented



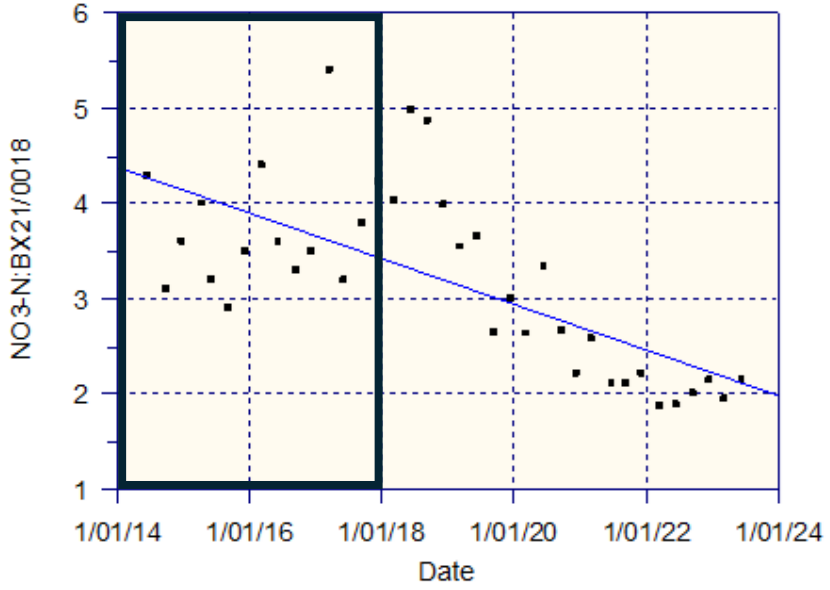
Decreases in contaminant concentrations were correlated to on-farm practice changes.



Cost ~$9400/yr/farm (cf. 1600-2550/yr)


Lake Coleridge
Waimakariri River
Christchurch
Selwyn River
Rakaia River
Te Waihora / Lake Ellesmere
Central Plains Water scheme area

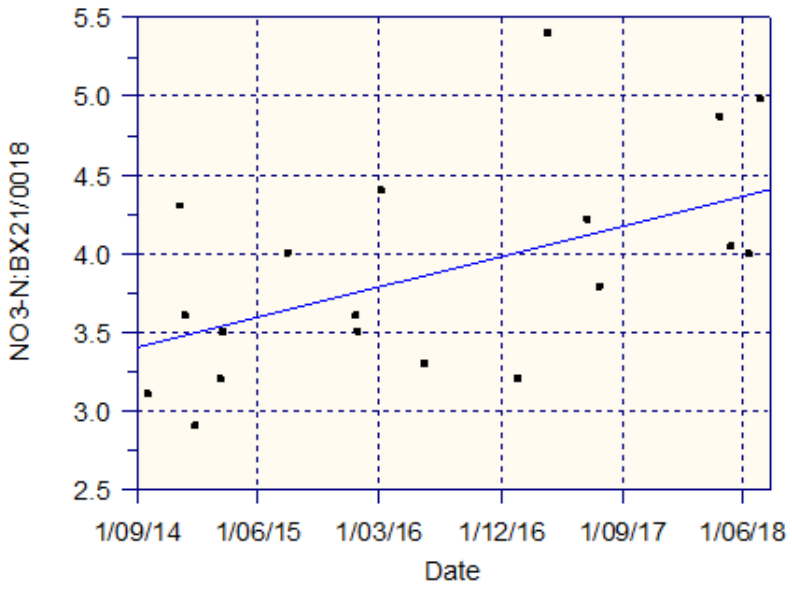
Groundwater trends?



Select all 10 years data

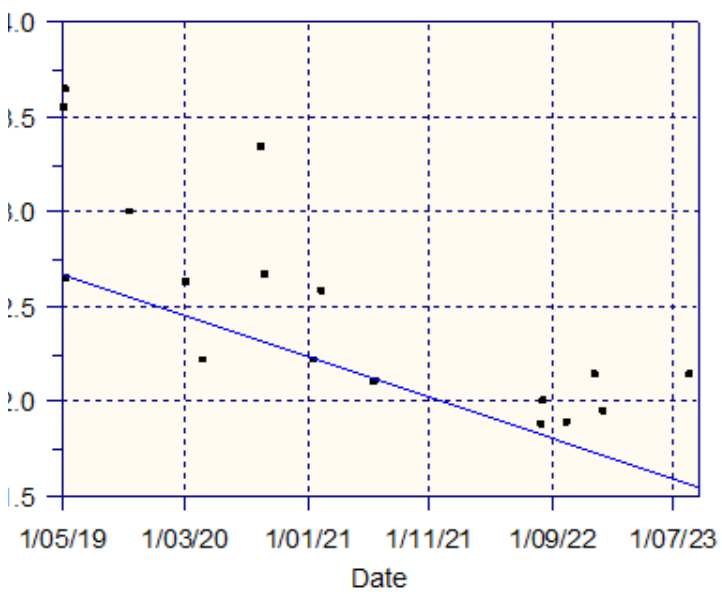
Leaching – mitigation + climate/lag

Recharge only 20% of normal



Select first 5 years data

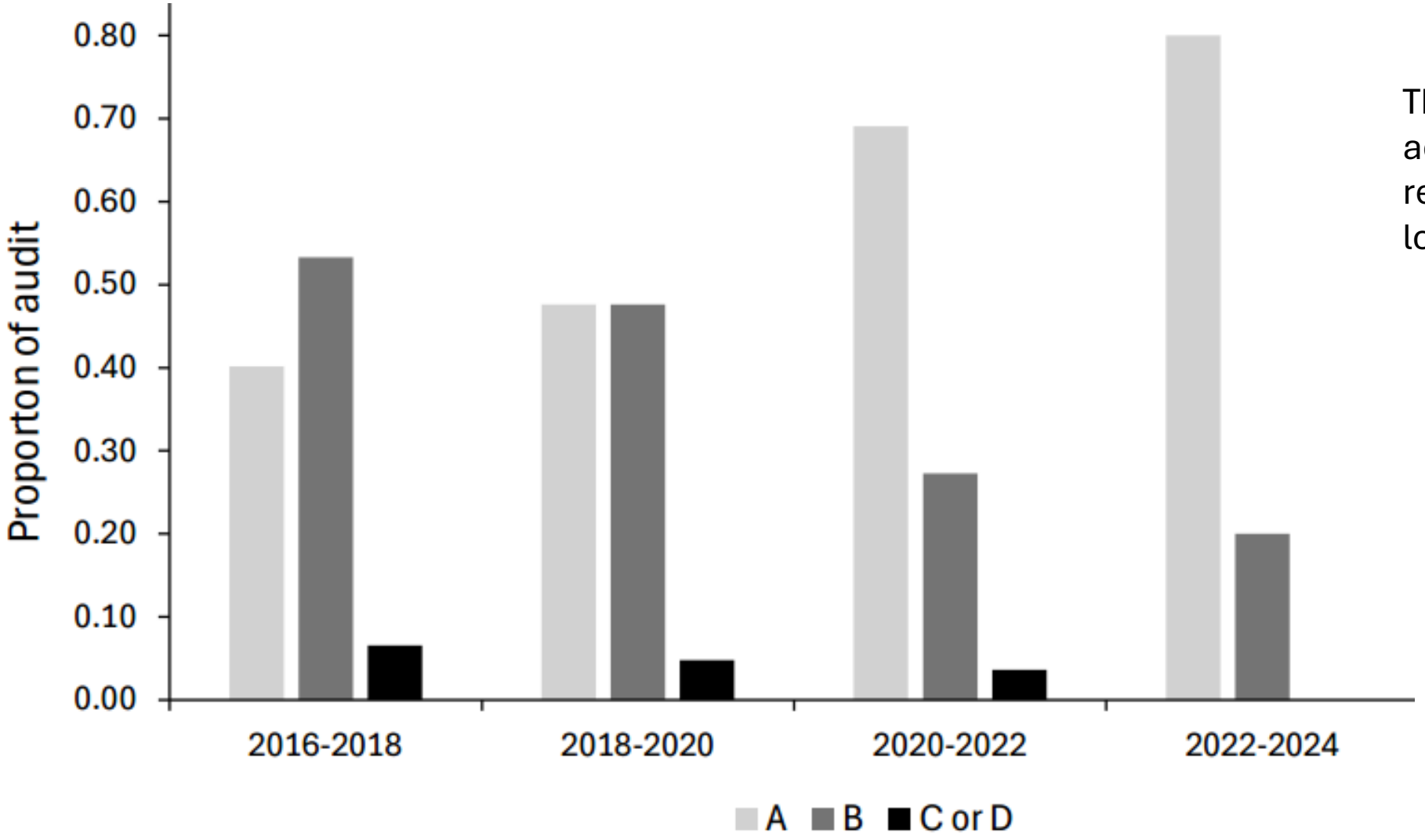
Problem?



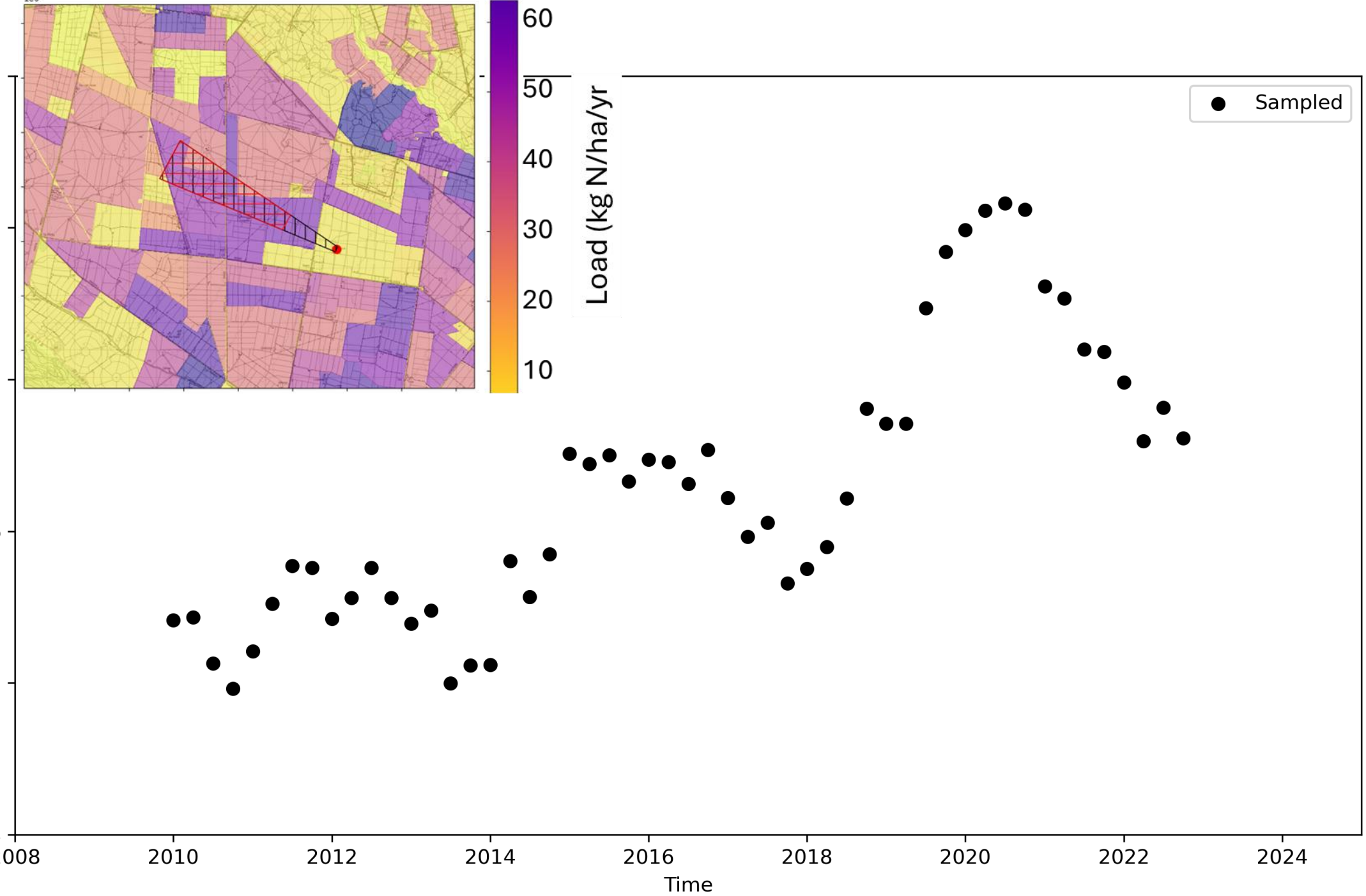
Select last 5 years data

Improvement?

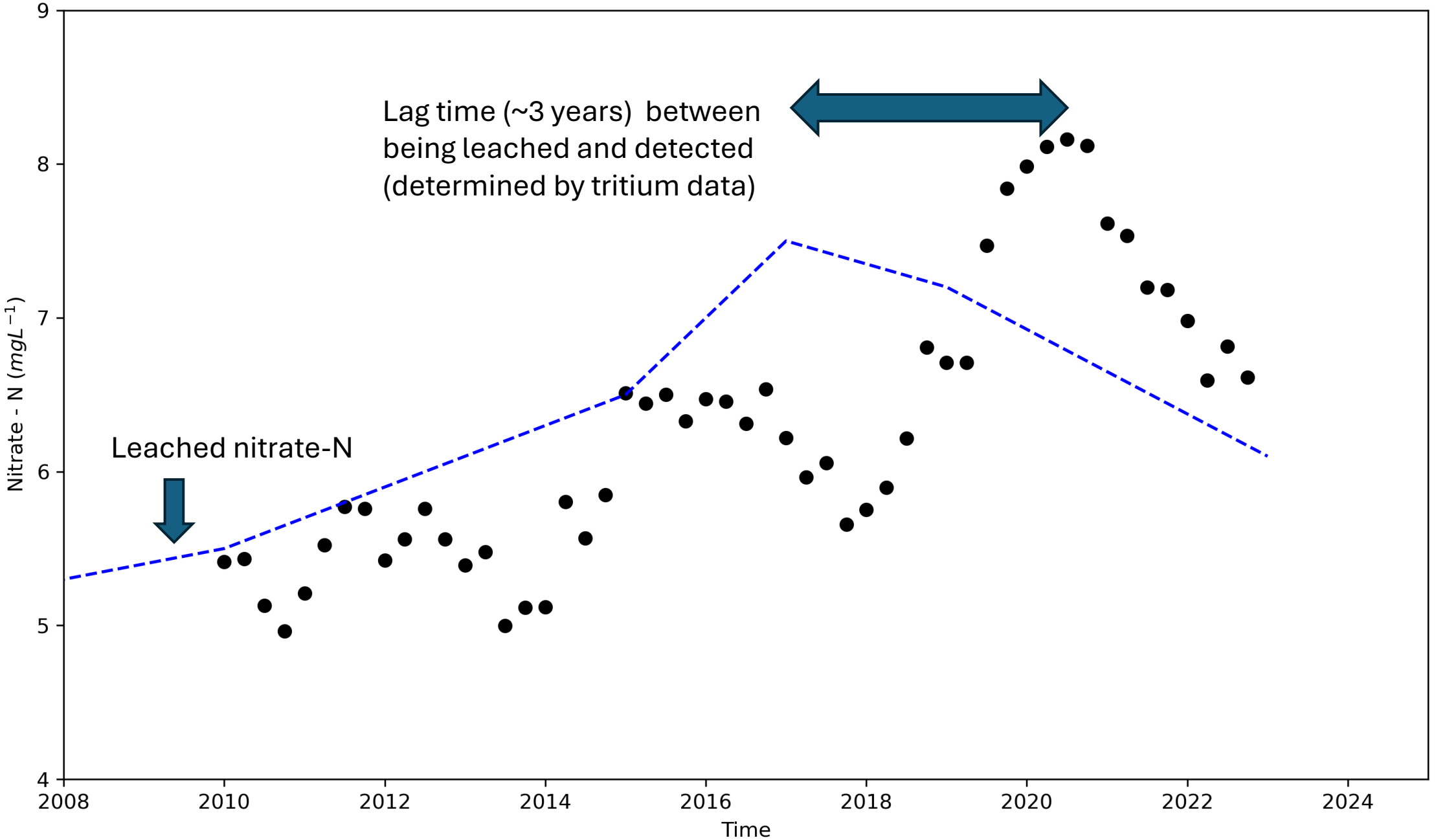
Farm plan audits



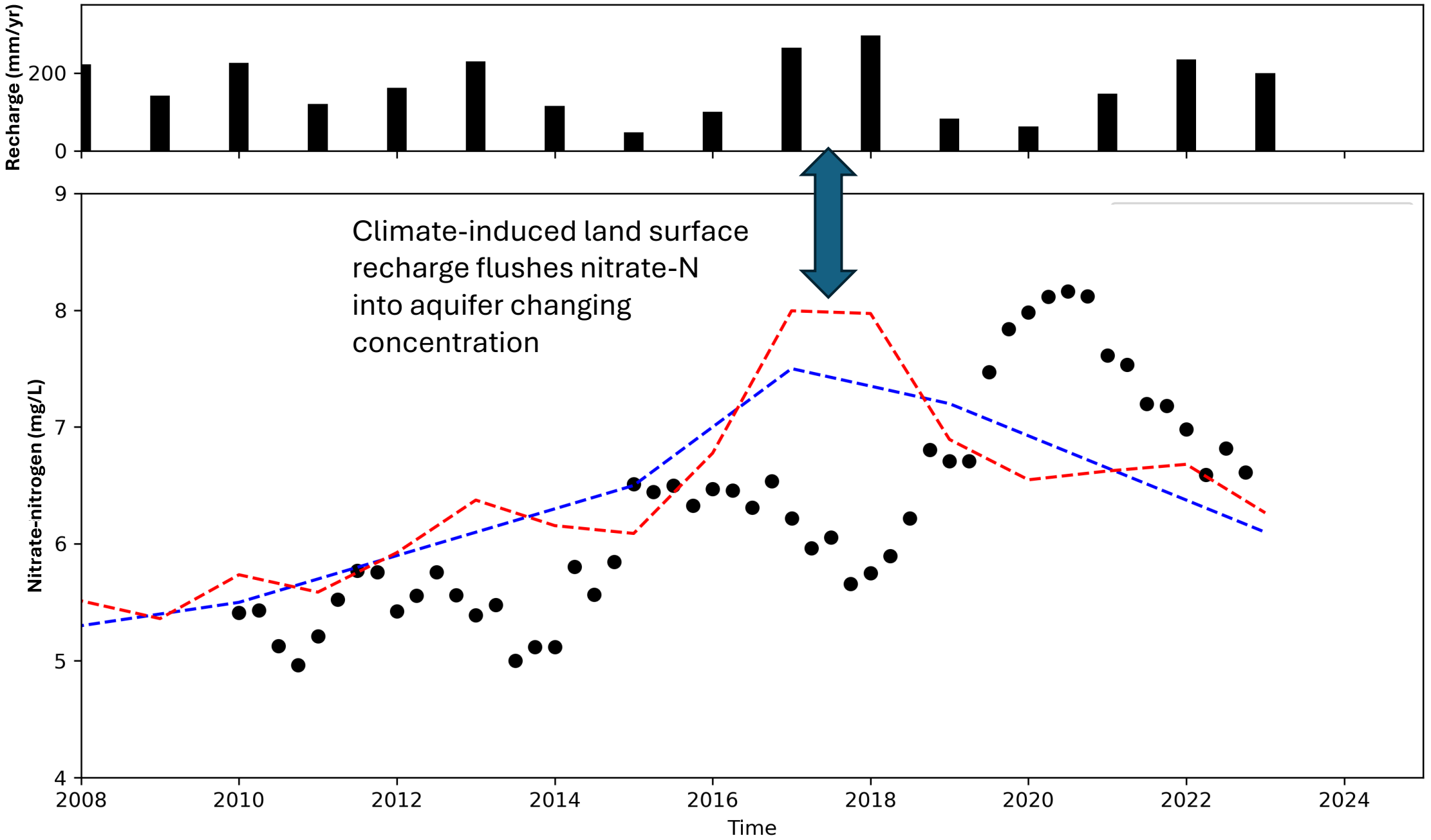
The implementation of actions is designed to reduce nitrate-nitrogen loss by 30%



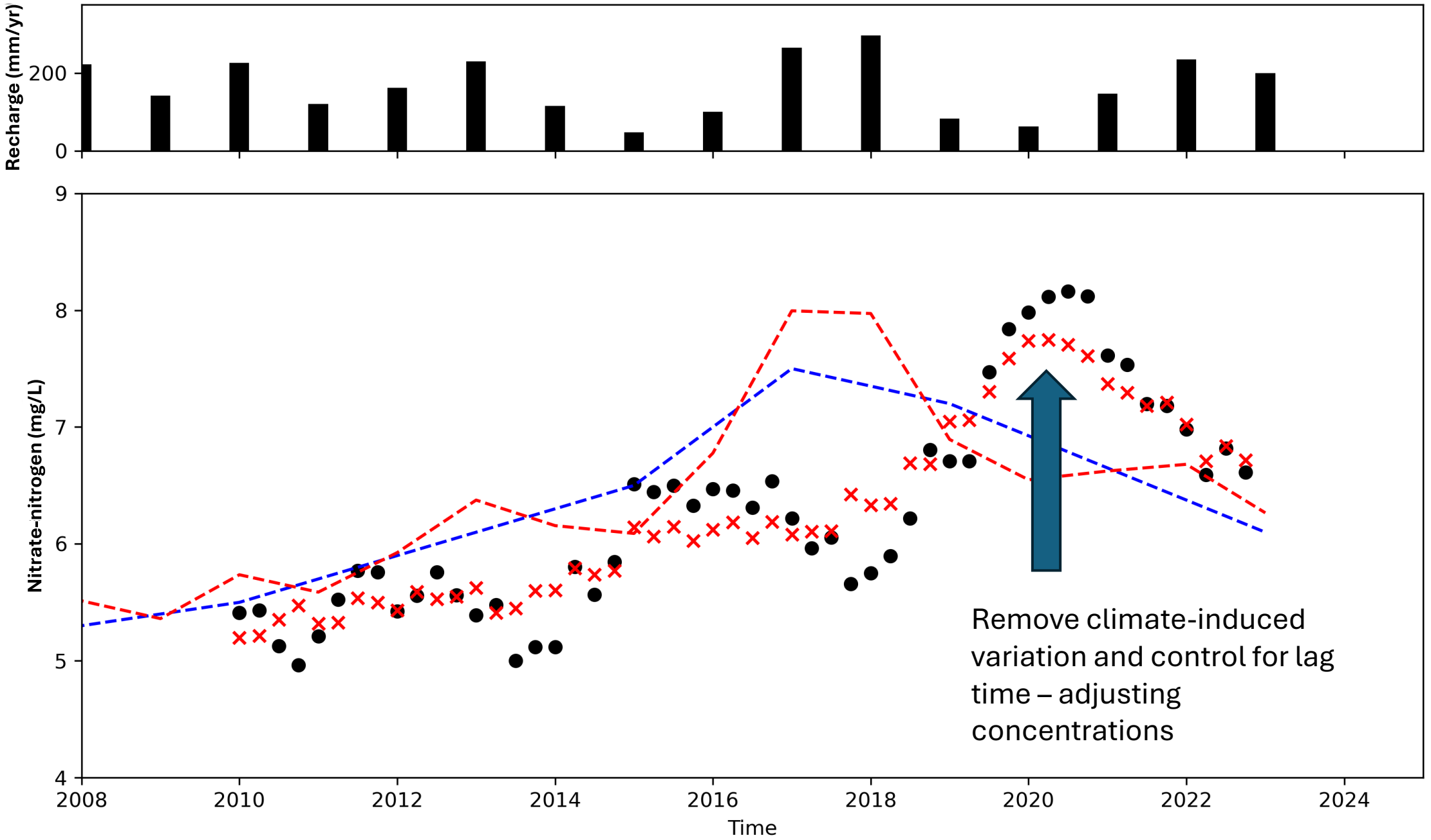
Well observations



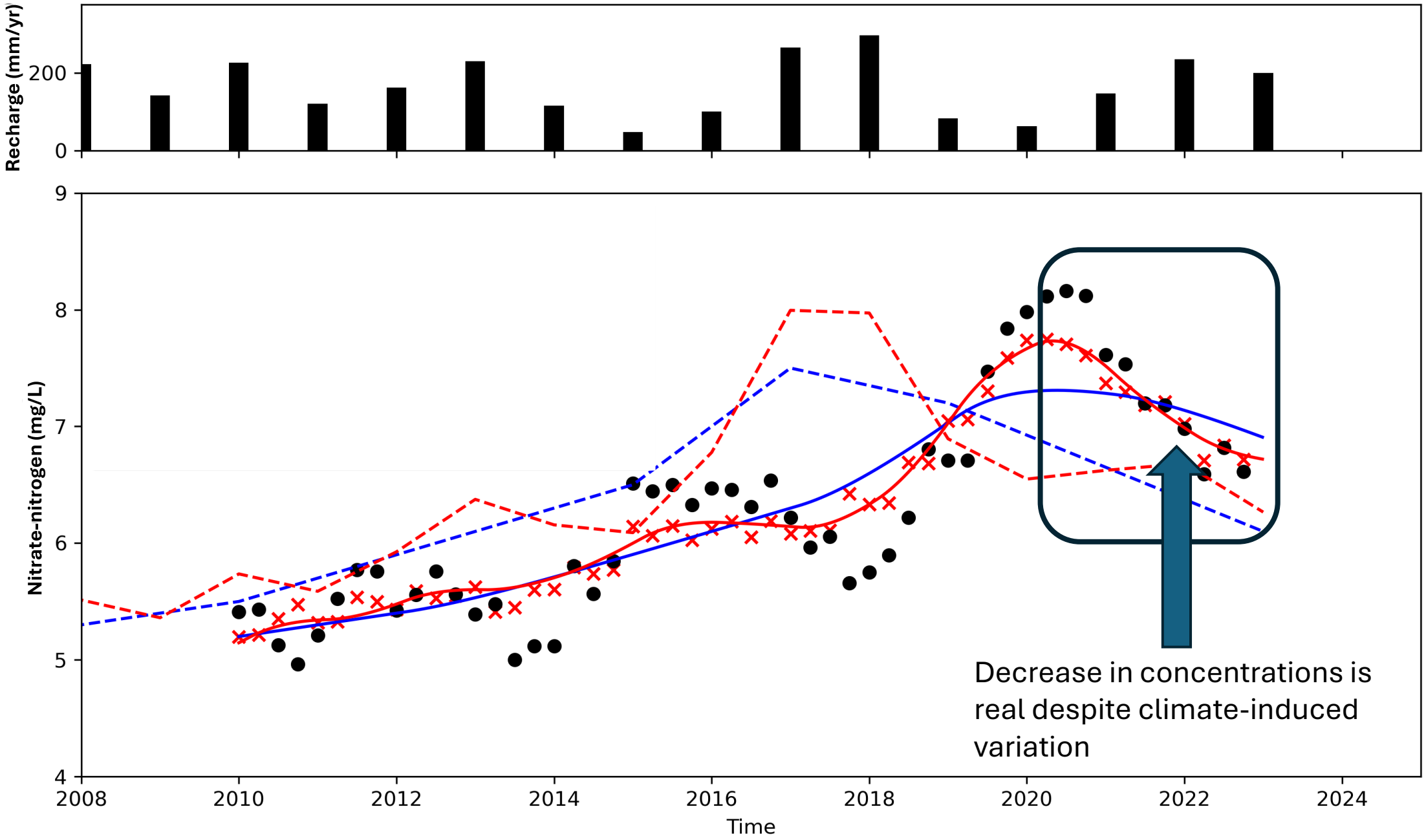
Account for lag time



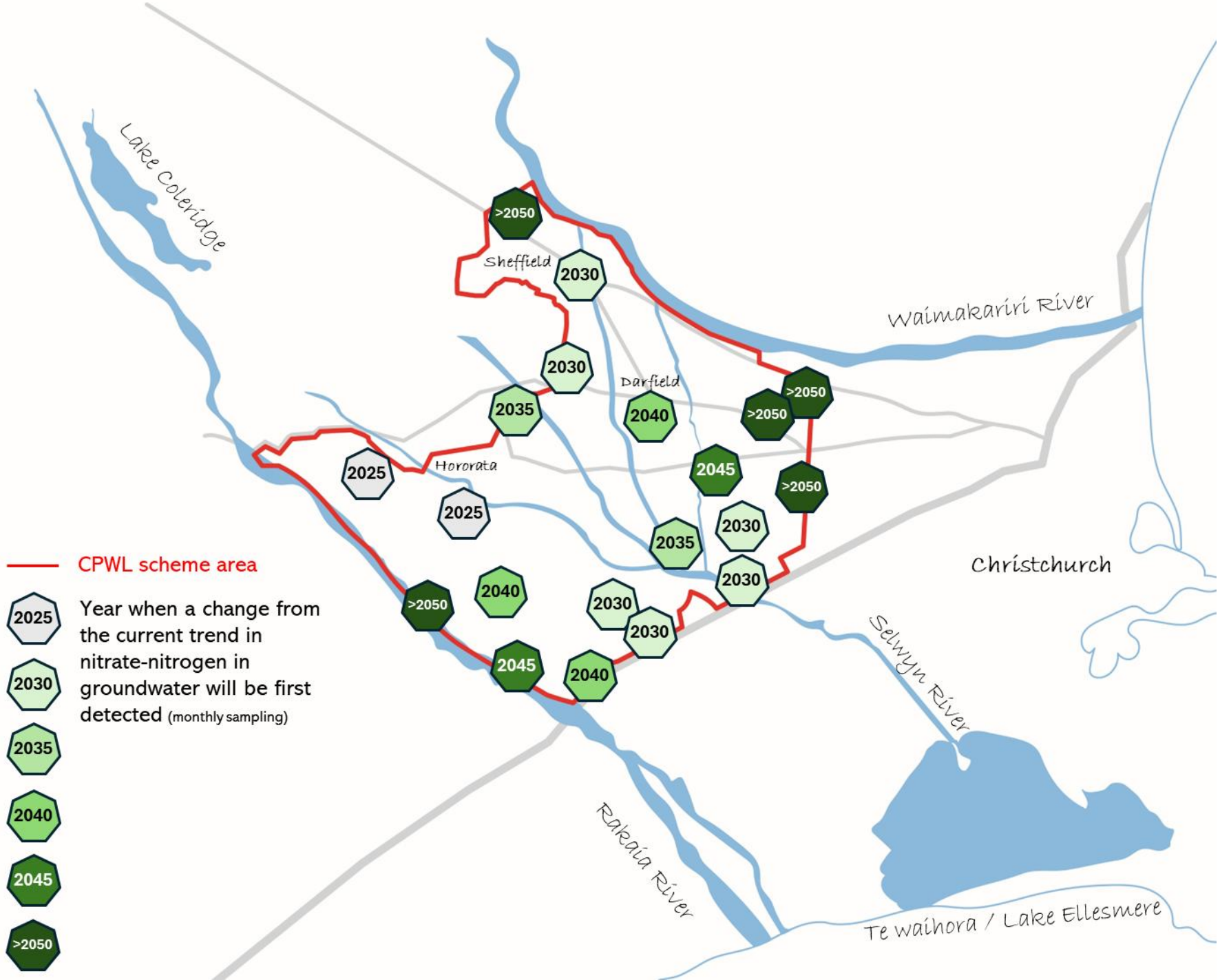
Account for climate



Determine real concentrations



Show if actions reduce losses


Lake Coleridge
Sheffield
Darfield
Hororata
Waimakariri River
Christchurch
Selwyn River
Rakaia River
Te waihora / Lake Ellesmere
CPWL scheme area
Year when a change from the current trend in nitrate-nitrogen in groundwater will be first detected (monthly sampling)
2025
2030
2035
2040
2045
>2050

Concluding remarks

1. Farm plans are an excellent way of linking actions to water quality improvements.

2. Estimating where and when water quality will improve can be done and gives those involved a timeline to work towards.

3. Emphasis should be put on implementation to ensure that we have the best chance of achieving improvements.

4. Additional actions may arise, but the effect of these can be included.