Optimising catchment management actions to receiving environments

(aka. Incorporating resilience and resistance in assessments of landuse suitability)

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OUR LAND AND WATER | Toitū te Whenua, Toiora te Wai | National Science Challenges

agresearch āta mātai, mātai whetū

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So that you can fall asleep….here are the main points

- I’m going to outline a strategy to optimise management actions to meet freshwater objectives.
- This strategy uses a benefit quotient that assesses cost, effectiveness, speed of treatment and their likely success in a receiving environment.
- This quotient can be used to guide land managers, investors and regulators in achieving an objective……(mostly).

Let’s begin

There’s a problem, but what do we do?

N P SS *E. coli*

Mitigations: actions that decrease the loss and transfer of contaminants from primary production enterprises to receiving environments.

Interventions: actions that increase the resilience (lessen the impact of contaminants) in receiving environments

The quandary of choice…

But limited information on:

- Cost, effectiveness, speed
- Context
- **Response in receiving environment**

Leads to a high level of **uncertainty** amongst land managers, investors and regulators, **inaction** or **subsidising** poor producers by doing too much to meet a water quality objective.

Our strategic solution

1. Collate and score info on cost, effectiveness, treatment speed of actions

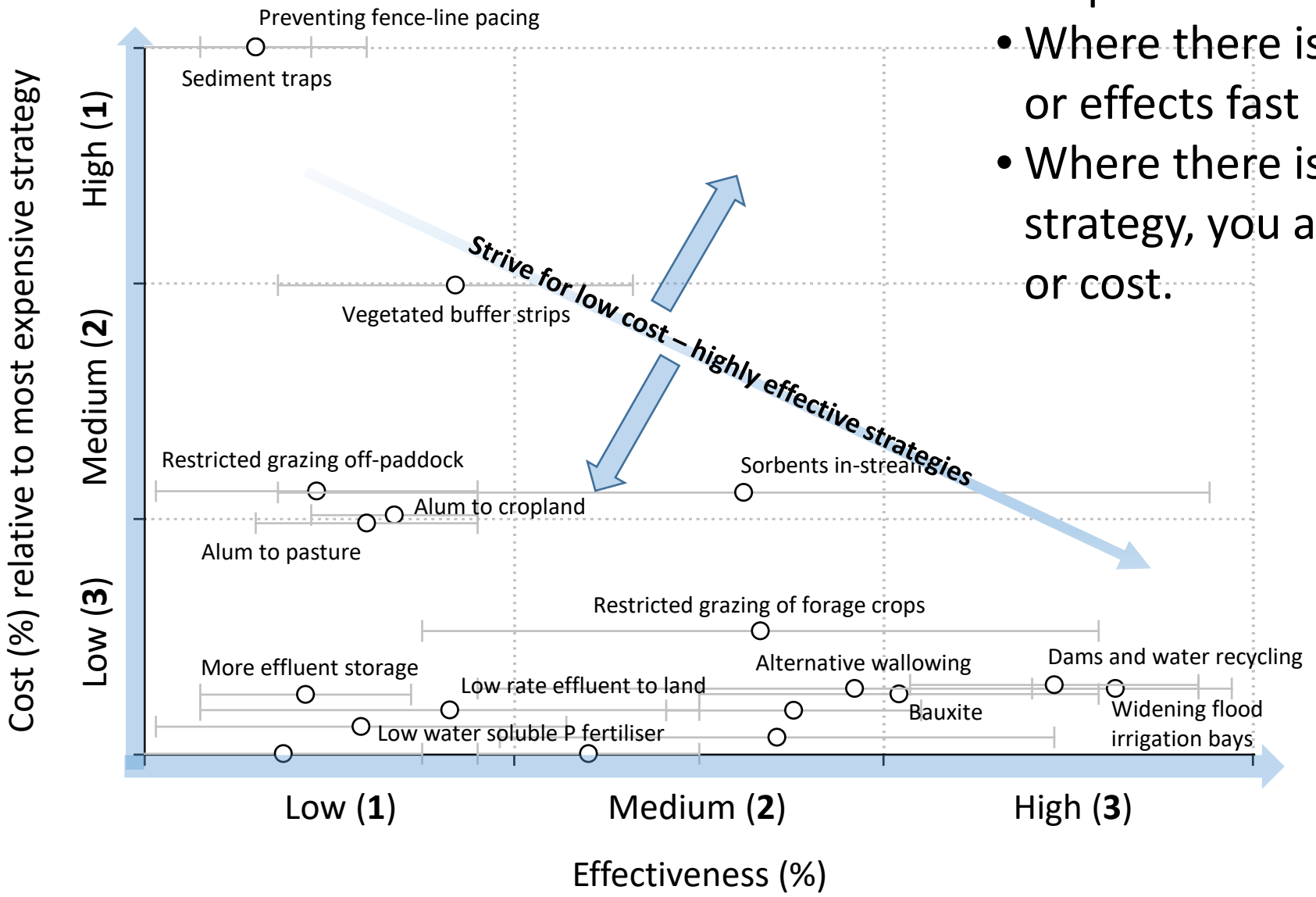
2. Give context on factors likely to result in successful actions

3. Propose a process to assess the need and likely success of actions according to a stressor-response curve in a receiving environment

1. Management actions

- Only included actions that had data for cost and effectiveness for three of more locations
- The mode and treatment speed was known, and
- The action was applicable over a wide geographic range

41 mitigations and 16 interventions



Except:

- Where there is need to reduce loads or effects fast
- Where there is a will for a specific strategy, you are restricted by location or cost.

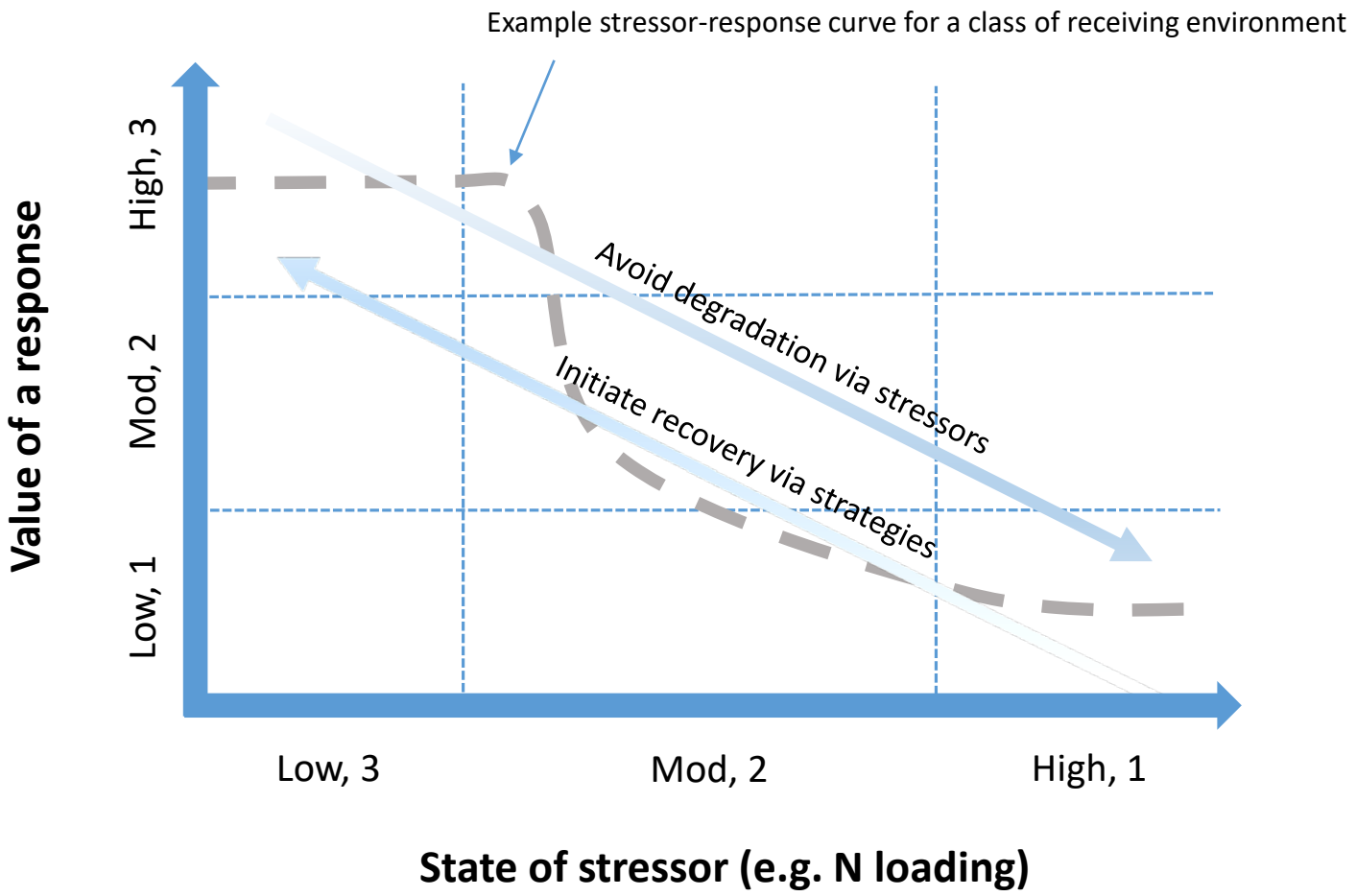
Speed of treatment
Slow (**1**)
Mod (**2**)
Fast (**3**)

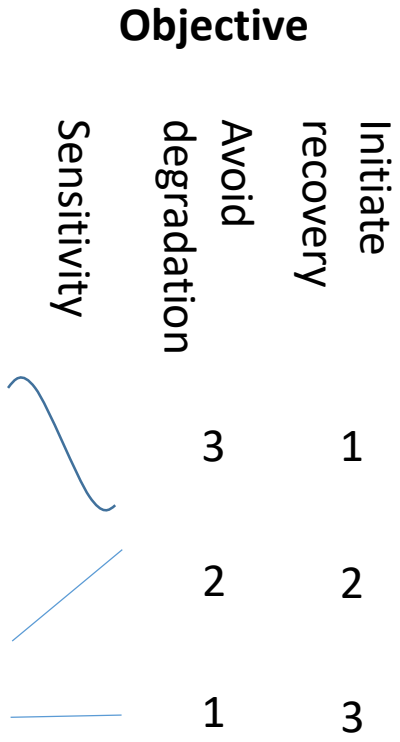
Poor performance = 1 × 1 × 1 = 1, Good performance = 3 × 3 × 3 = 27

2. Context for successful actions

- **Specificity** (*horses for tracks in certain locations and conditions*)
- **Placement and timing** (*targeting CSAs 6-7 times better than untargeted*)
- **Co-benefits** (*targeting a 2 or more contaminants*)
- **Longevity** (*not the same as treatment speed*)
- **Uncertainties in cost-effectiveness** (*use categories*)
- **Unintended consequences** (*positive or negative*)

3. The receiving environment





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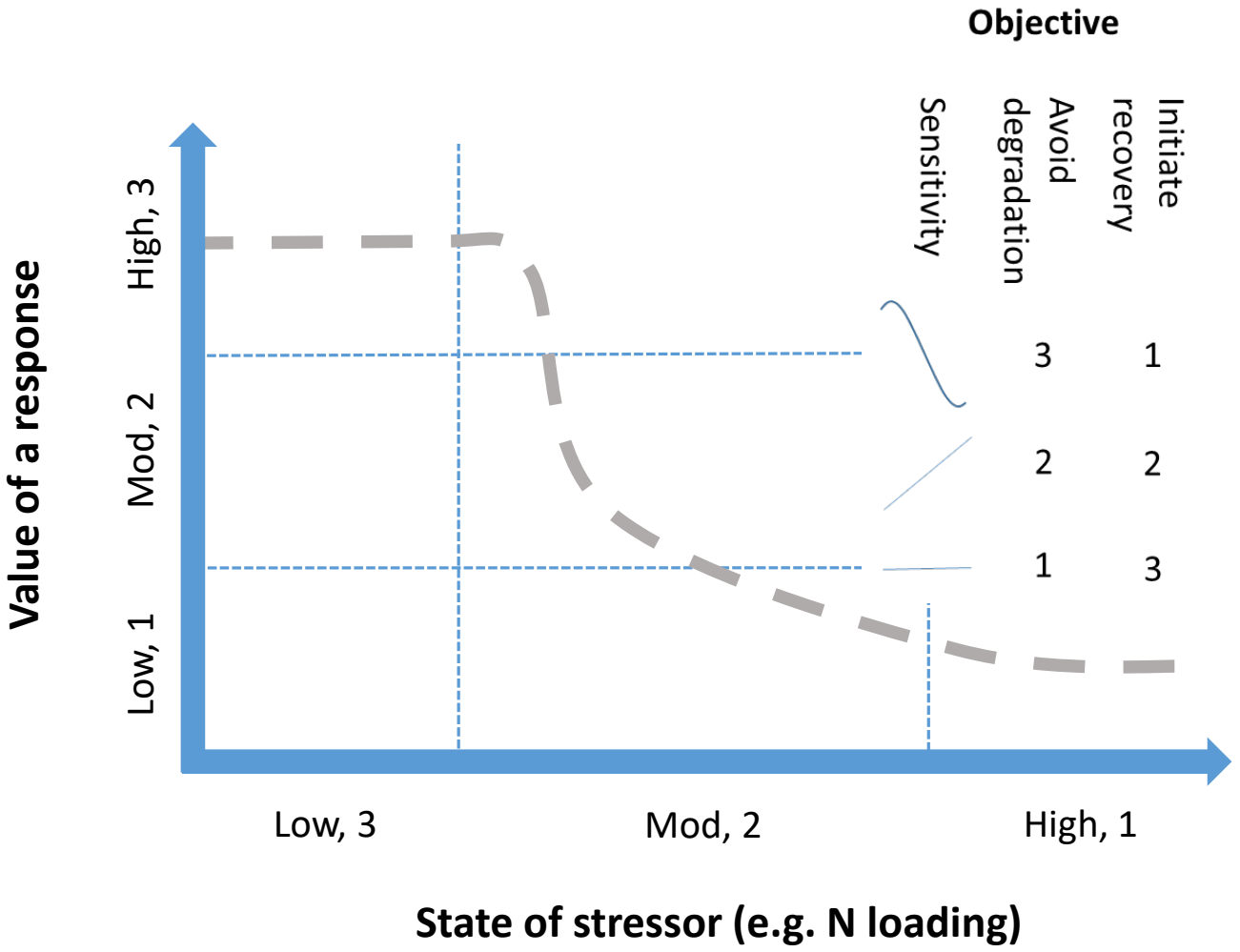


If objective is to **avoid degradation** the position on the curve at most risk of degradation is high value (3), low stressor state (3) and is sensitive (3) = 27

If objective is to **initiate recovery** the position on the curve with the best prospect of recovery has a low response (1) with a high stressor state (1) and high sensitivity (1) = 1.

Benefit Quotient

Informs land managers, investors, regulators of the best actions to use to meet an objective

Aiming for as high a score (max = 27) as possible

$$\frac{\text{Score for management actions}}{\text{Score for S-R curve in receiving environment}}$$

Avoid degradation
(best prospect = 27)

1 → **27**

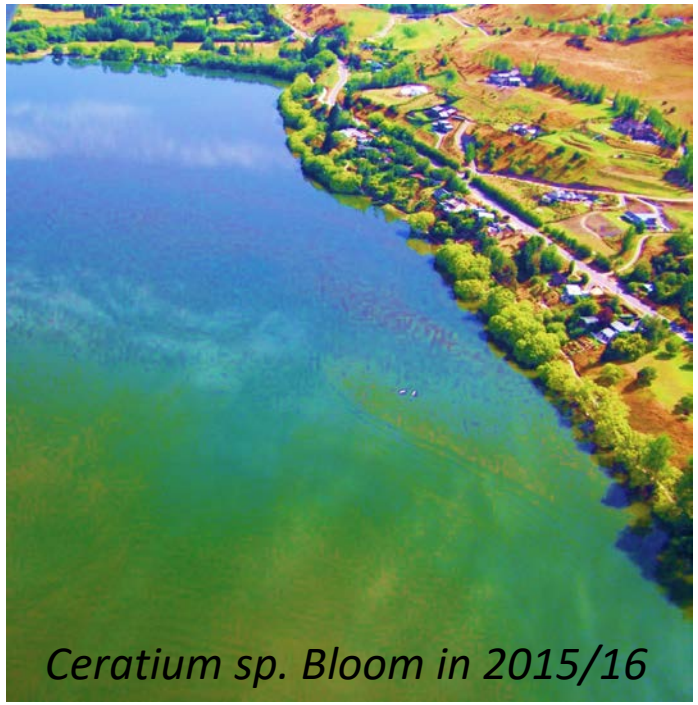
Initiate recovery
(best prospect = 1)

Putting our strategy into action

- An objective is set
- A stressor-response curve is established (or already known)
- Scores are assessed for the position on S-R curve
- Cost, effectiveness and treatment speeds of suitable actions scored
- Benefit quotients created for actions
- We all sing Kumbaya…

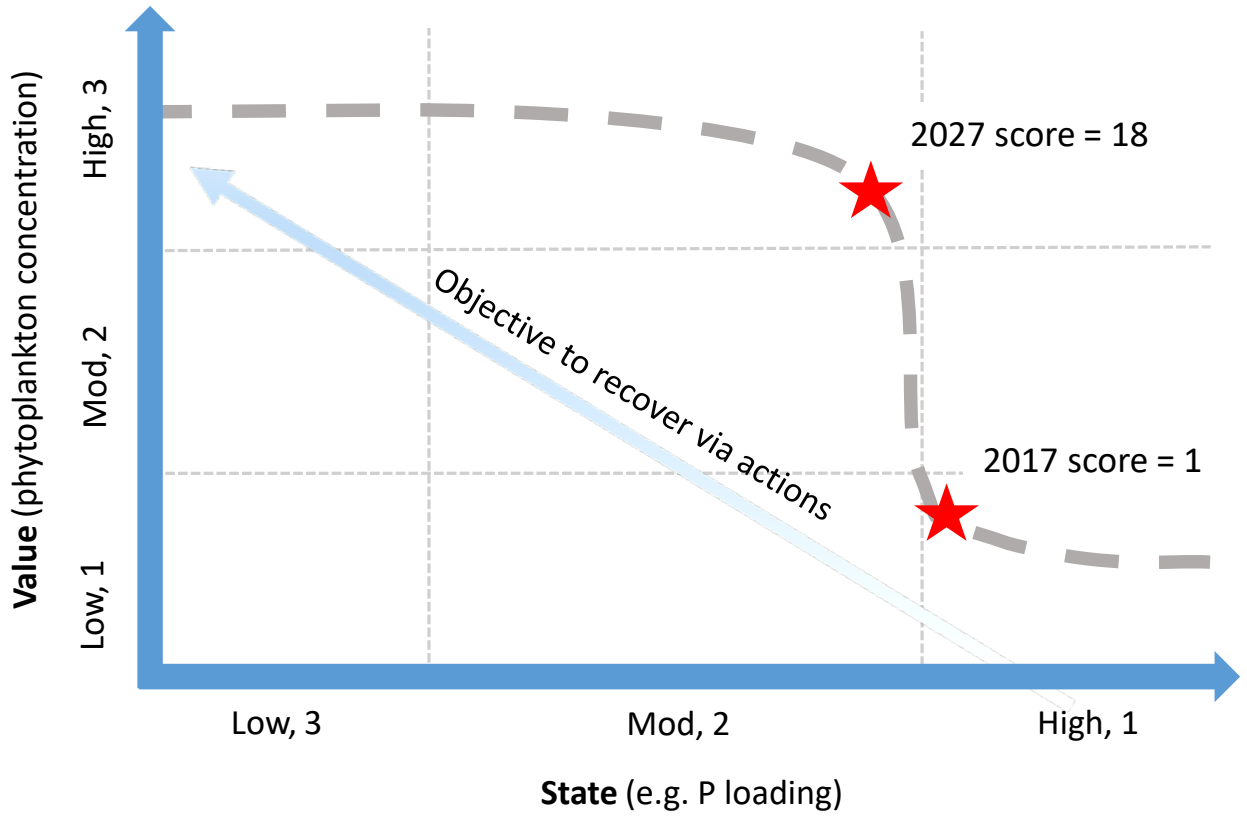
An example: Lake Hayes

250 ha, largely drystock



Ceratium sp. Bloom in 2015/16

Situation – 2017 and 2027



Prioritising mitigations and interventions

Action	Action score	Benefit quotient 2017 (denominator = 1)	Benefit quotient 2027 (denominator = 18)
Stream fencing	27	27	1.5
Restricted grazing of forage crops	18	18	1
Sediment traps	3	3	0.16
Alum dosing	18	18	1

Should consider switching to avoiding degradation?