

SUSTAINABLE
SEAS

Ko ngā moana
whakauka

A systems approach to understanding marine stressors in Hawke's Bay

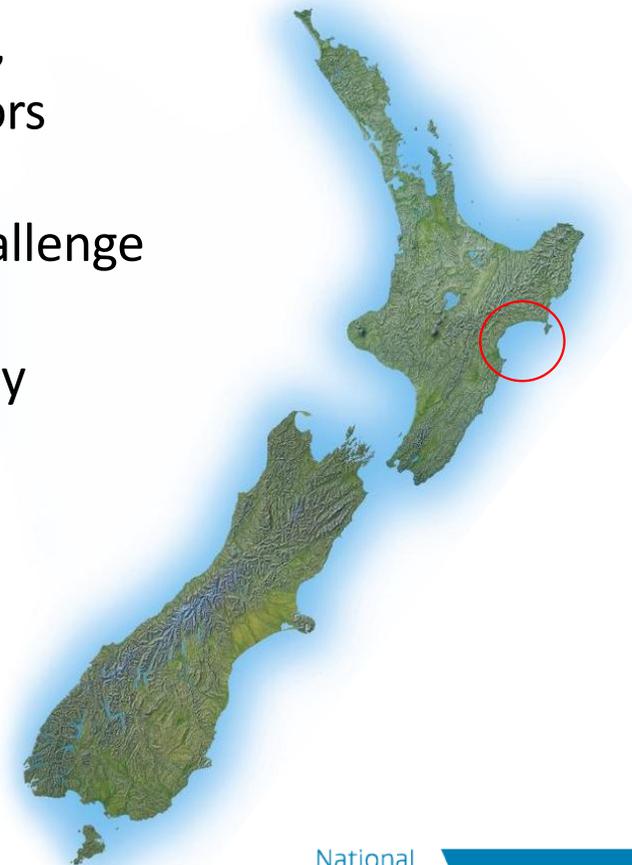
Justin Connolly, Carolyn Lundquist,
Becky Shanahan and Anna Madarasz-Smith

What we will cover

- Sustainable Seas Hawke's Bay Case Study
- Hawke's Bay Marine and Coast Group (HBMaC)
- What is systems thinking?
- Overview of system map developed with HBMaC
- Exploring possible futures
- Next steps...
- Questions

Why? Hawke's Bay case study

- Navigate a real-world EBM case study in a multi-use, multi-sector space with multiple overlapping stressors
- Opportunity to trial EBM tools developed by the Challenge
- Existing data and knowledge to inform the case study
- 2 year, \$300,000 investment in Challenge research within the Hawke's Bay
- Co-developed with HBMaC stakeholder group



Collaborative decision-making

Collaborative, co-designed and participatory decision-making processes involving all interested parties.



Tailored

Place and time specific, recognising all ecological complexities and connectedness, and addressing cumulative and multiple stressors.



Co-governance
Governance structures that provide for Treaty of Waitangi partnership, tikanga and mātauranga Māori.



EBM Ecosystem-based management for Aotearoa

A holistic and inclusive way to manage marine environments and the competing uses for, demands on, and ways New Zealanders value them.

Human activities

Humans, along with their multiple uses and values for the marine environment, are part of the ecosystem.



Sustainability
Marine environments, and their values and uses, are safeguarded for future generations.



Knowledge-based

Based on science and mātauranga Māori, and informed by community values and priorities.



Adapts

Flexible, adaptive management, promoting appropriate monitoring, and acknowledging uncertainty.



National
science
Challenges

SUSTAINABLE
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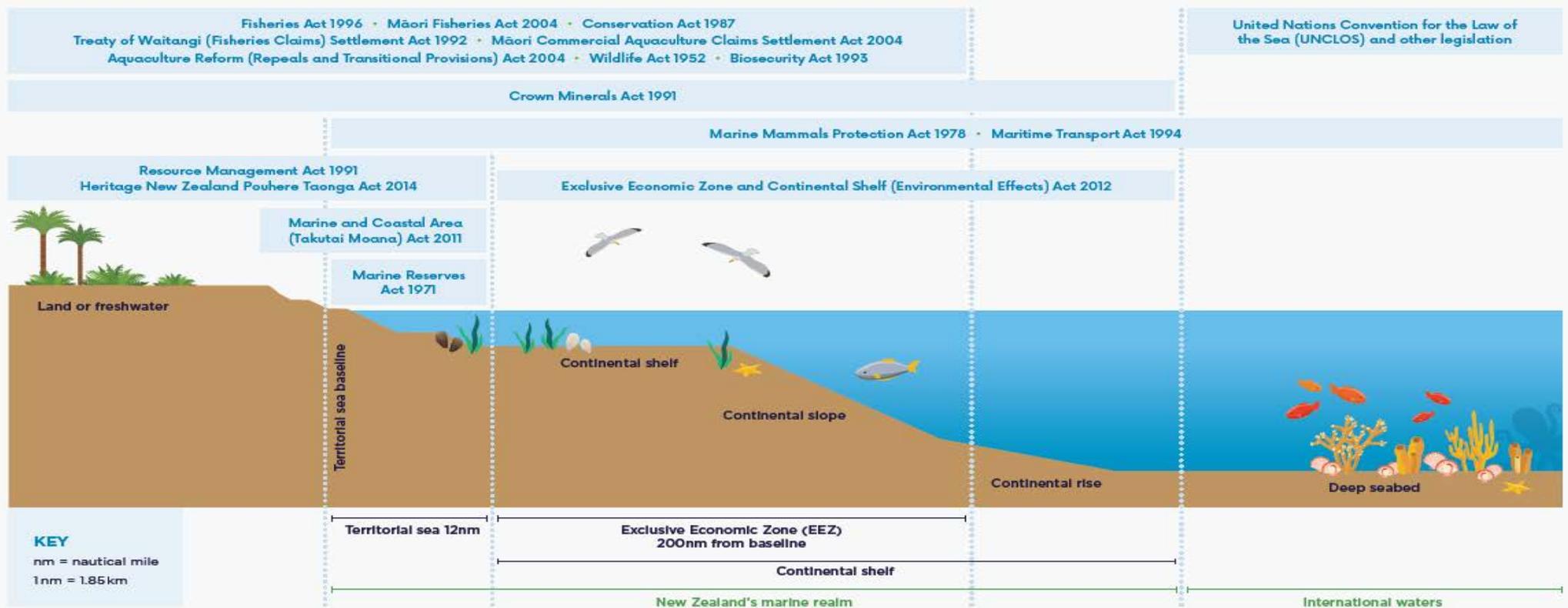
Timeline: Hawke's Bay case study

- Case Study Phase 1 (2019-2020):
 - Systems map of the relative contribution and interaction of **multiple stressors** in the HB marine environment, particularly land-based sediment inputs and the effects of fishing activities
 - Fill in the systems map with known information to identify information gaps
- Case Study Phase 2 (2020-2021):
 - Use tools developed by the Challenge to inform stressor management in Hawke's Bay

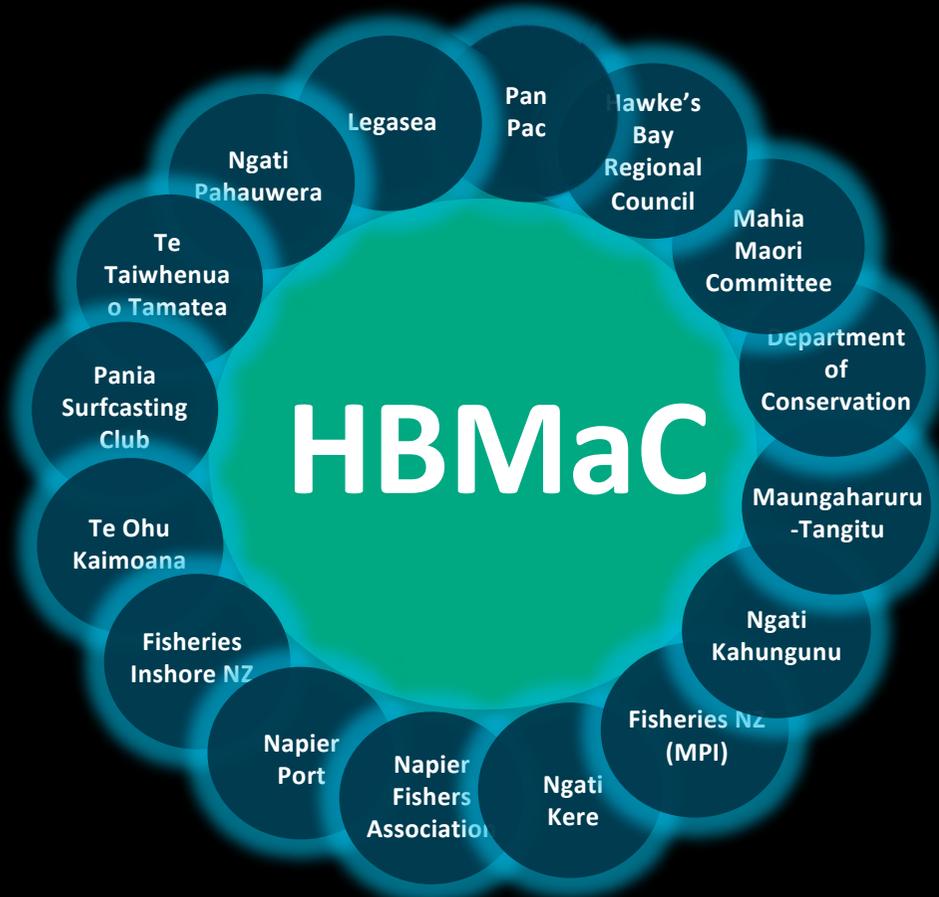


Aotearoa New Zealand's key marine legislation

This graphic shows key pieces of legislation for protecting the marine environment and managing its resources. It is not an exhaustive list of all national and international legislation in the marine space, nor does it depict the numerous rules and regulations in the legislation.



Hawke's Bay Marine and Coast Group



- Formed in 2016 over perceived:
 - depletion of inshore finfish stocks
 - environmental degradation in Hawke's Bay

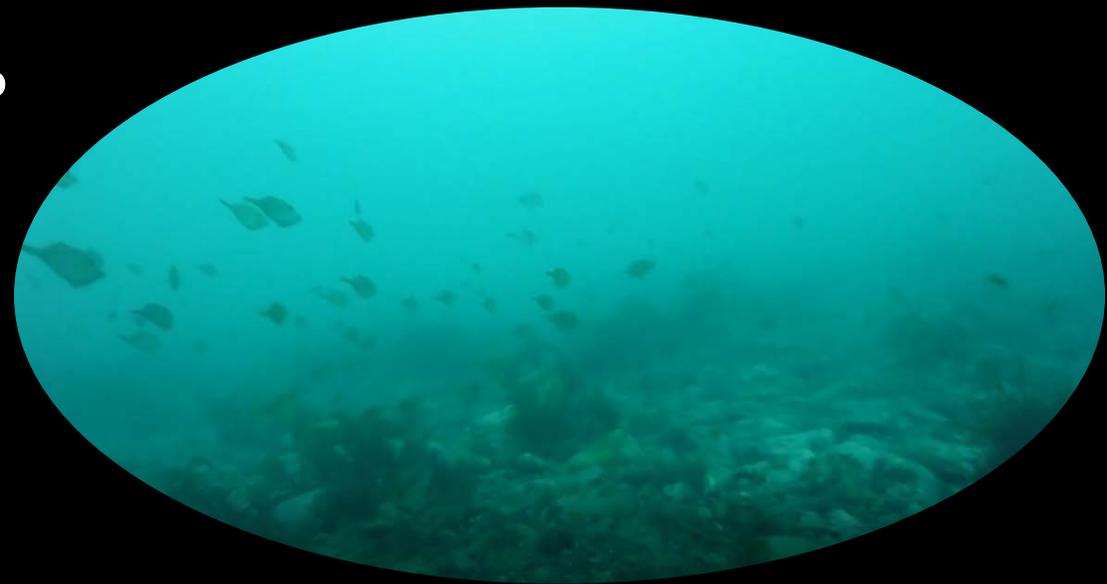
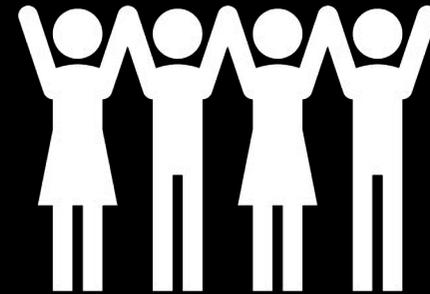
Hawke's Bay Marine and Coast Group



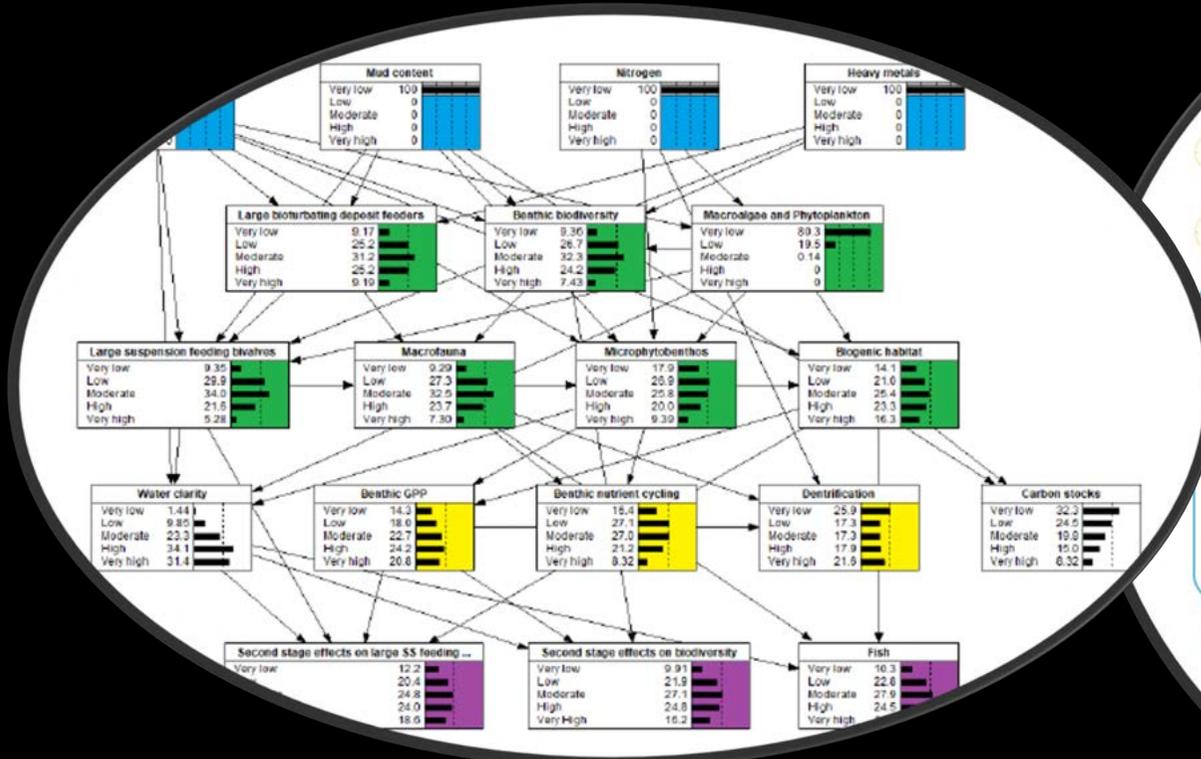
- Formed in 2016 over perceived:
 - depletion of inshore finfish stocks
 - environmental degradation in Hawke's Bay
- Vision
 - "achieve a healthy and functioning marine ecosystem in Hawke's Bay that supports an abundant and sustainable fishery"*

Why Sustainable Seas?

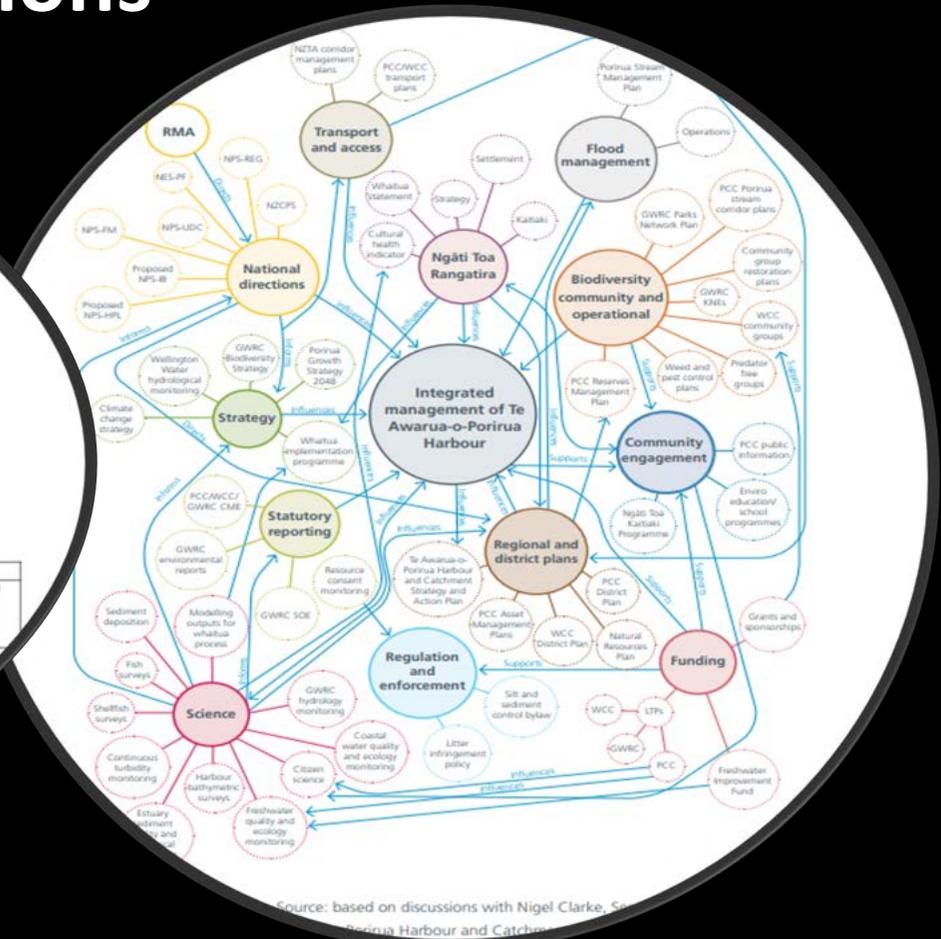
- Willing and invested collaborative group
- Desire to make real change
- Collaboratively designed research roadmap
- But what next?
How do multiple stressors interact?
- What needs to happen?
In what order, scale?



Layering of complex interactions



Source: Bulmer and Hewitt (2020). Bayesian modelling of multiple stressors on six Hawke's Bay estuaries.



Source: Parliamentary Commissioner for the environment (2020). Managing our estuaries.

What is *systems thinking*?

The Systems

11 JUN 2019

GOOD NEWS! YOU ALREADY KNOW A LOT ABOUT SYSTEMS!

By JUSTIN CONNOLLY

1969).

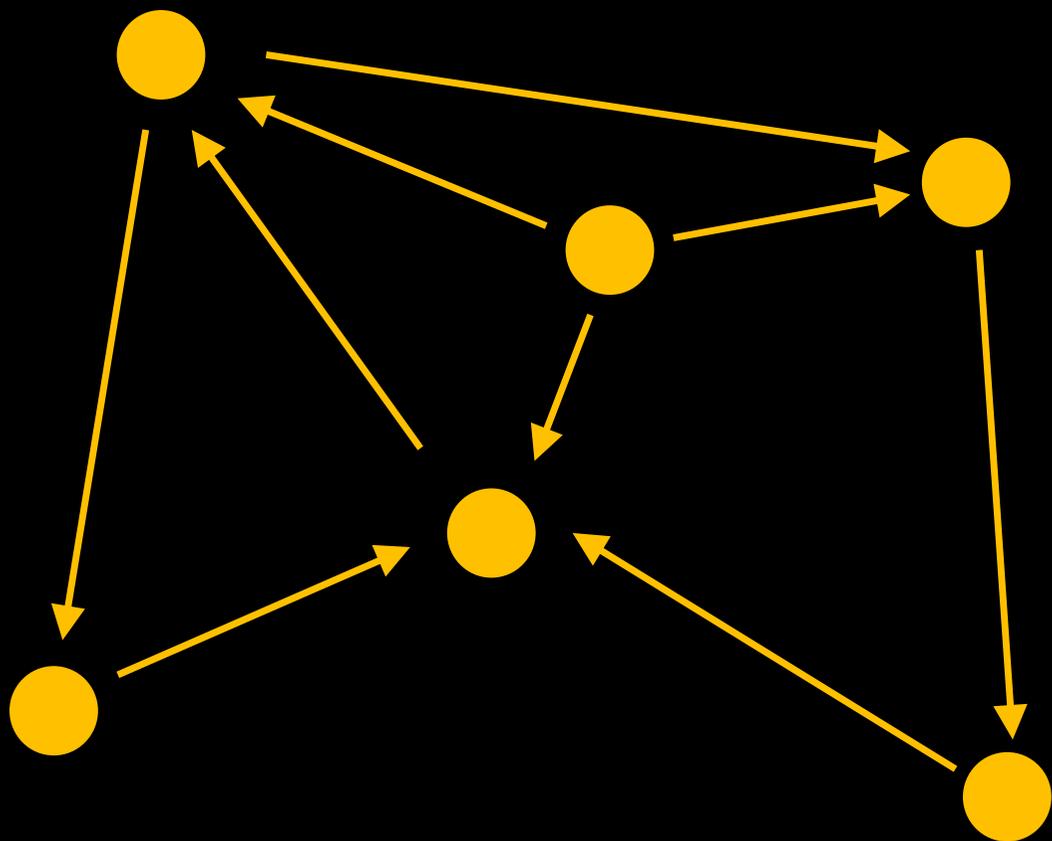
Many large cities have experienced a period of rapid growth followed by a period of rapid decay. The model Forrester presents in Urban Dynamics portrays a city as a system of interacting industries, housing, and people. At the onset, the model simulates a city that grows rapidly. However, as its empty space fills, the simulated city becomes relatively full, growth stagnates, and decay in the form of ageing housing and industry resembles the unfortunate reality of many large cities face.

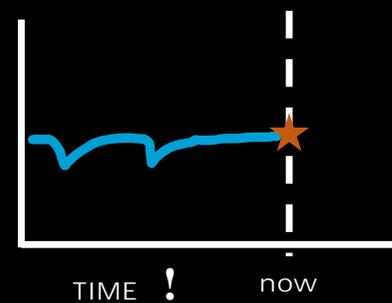
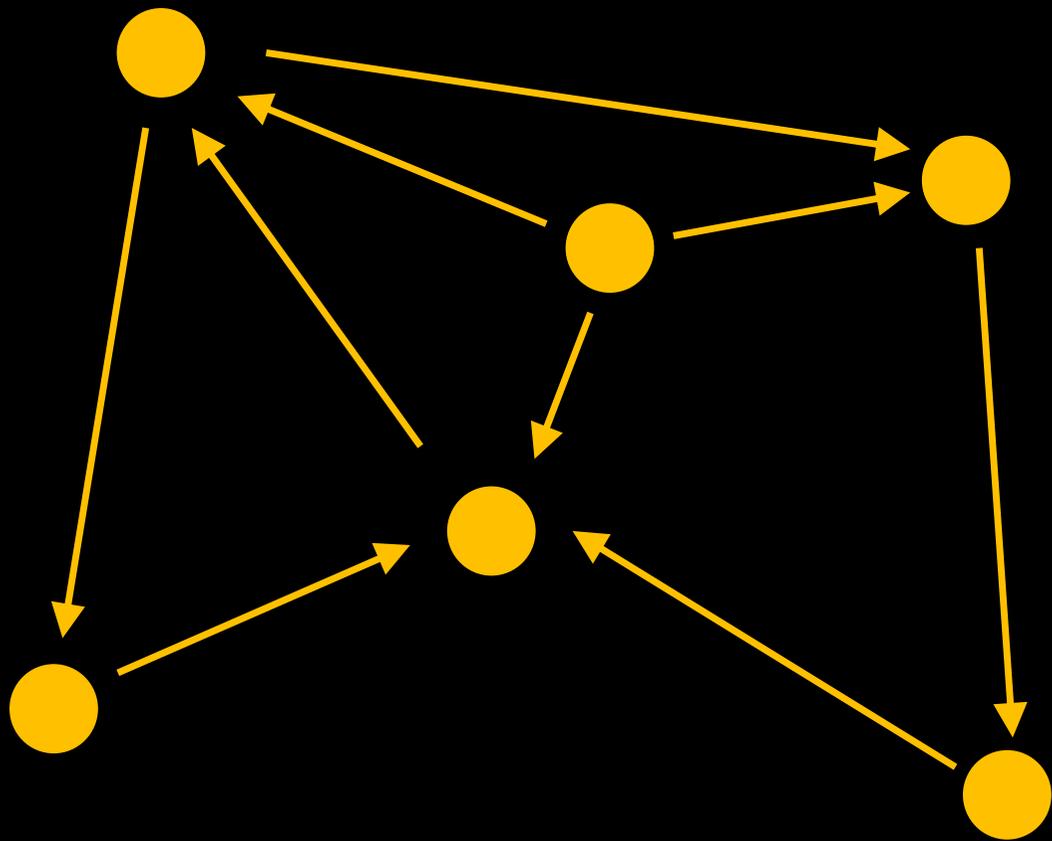
beliefs are separated, how decisions are made, and the form of uncertainty can be acknowledged. In a system dynamic perspective can occur.

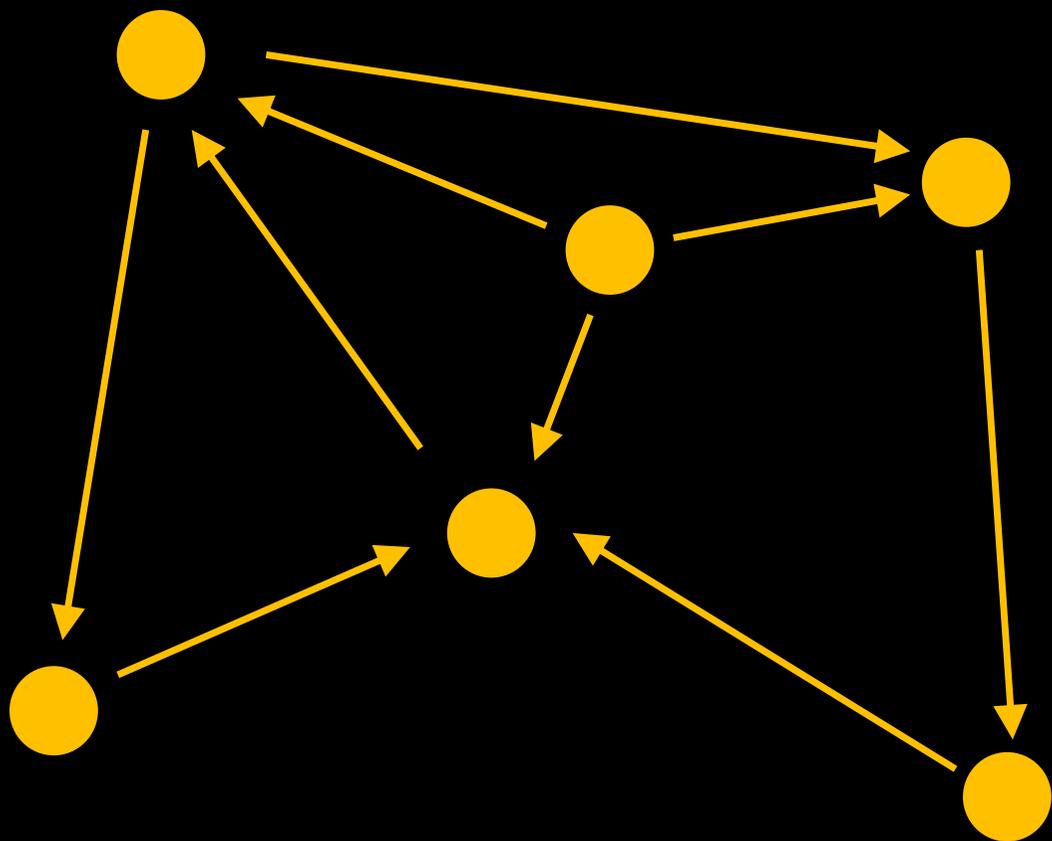
In a system dynamic perspective, decisions and their consequences are more easily examined. The simulation of past and present actions to be taken with system variables decision makers to learn from and lagged feedback loops in decision-making (Munz 1985, Forrester 1989). Systems thinking would not be possible without the fundamental principles of systems engineering.

initiated the field of systems engineering.

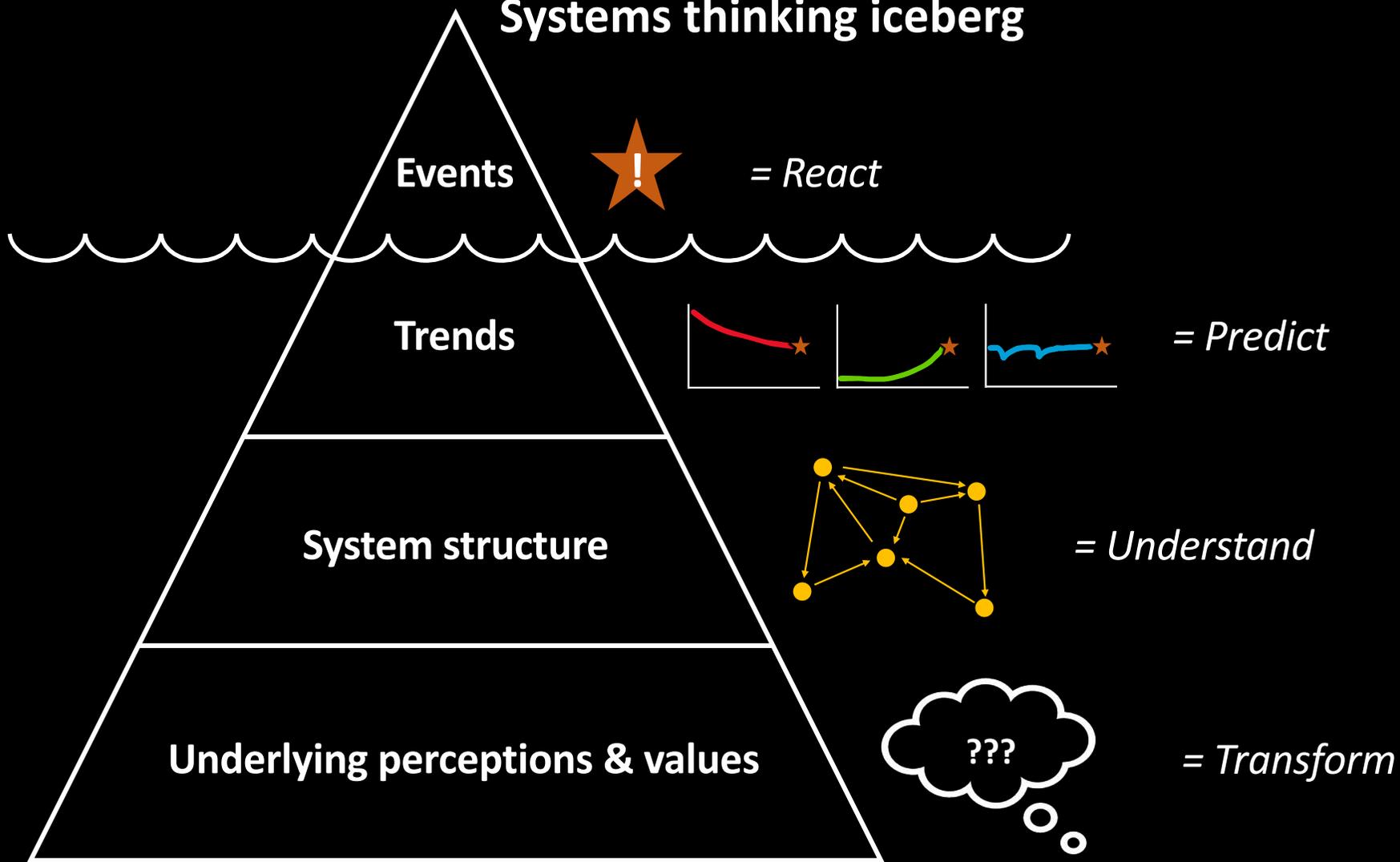
Forrester simulated popular initiatives, such as the construction of housing, and would not be possible without the fundamental principles of systems engineering.



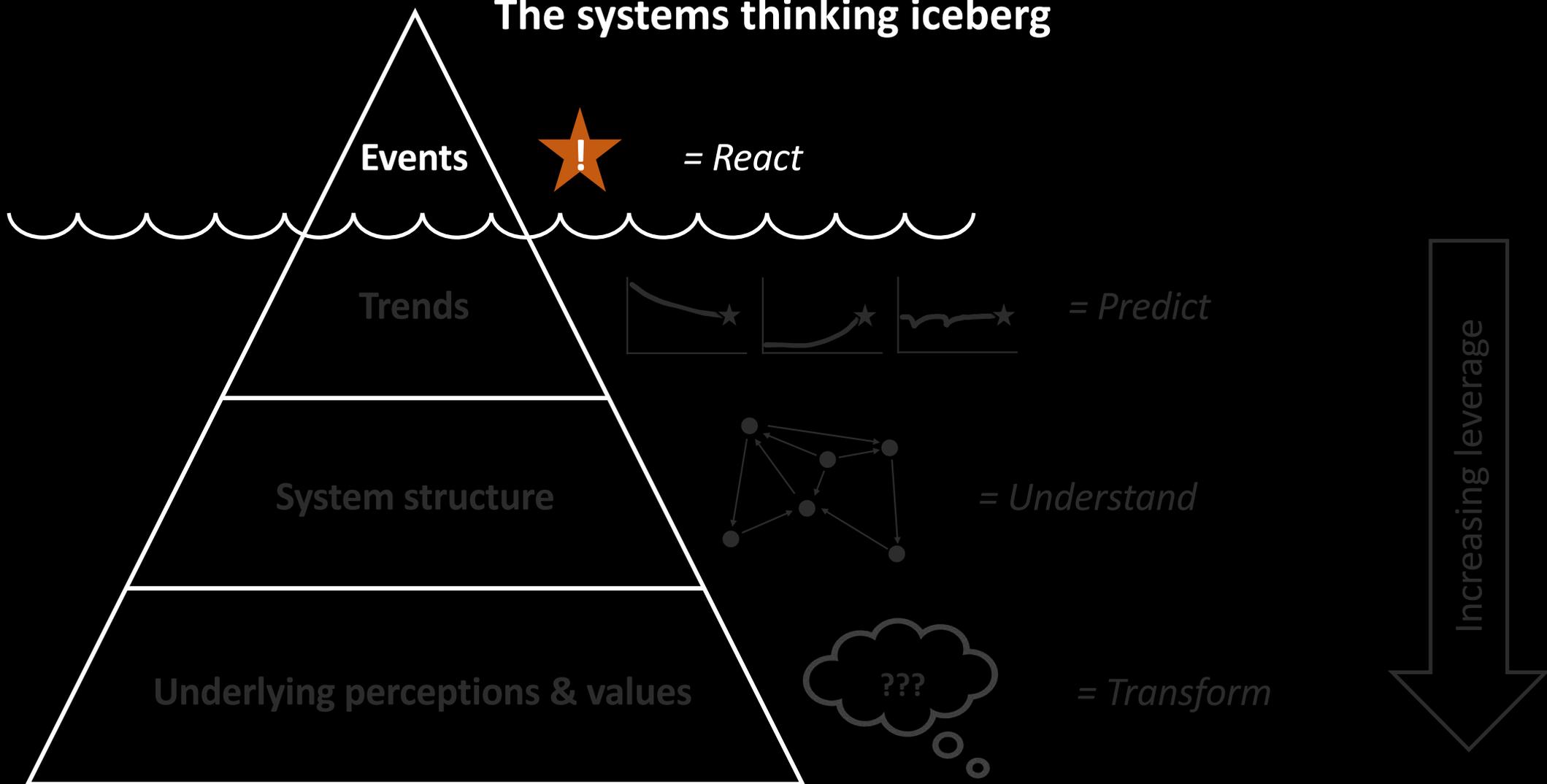




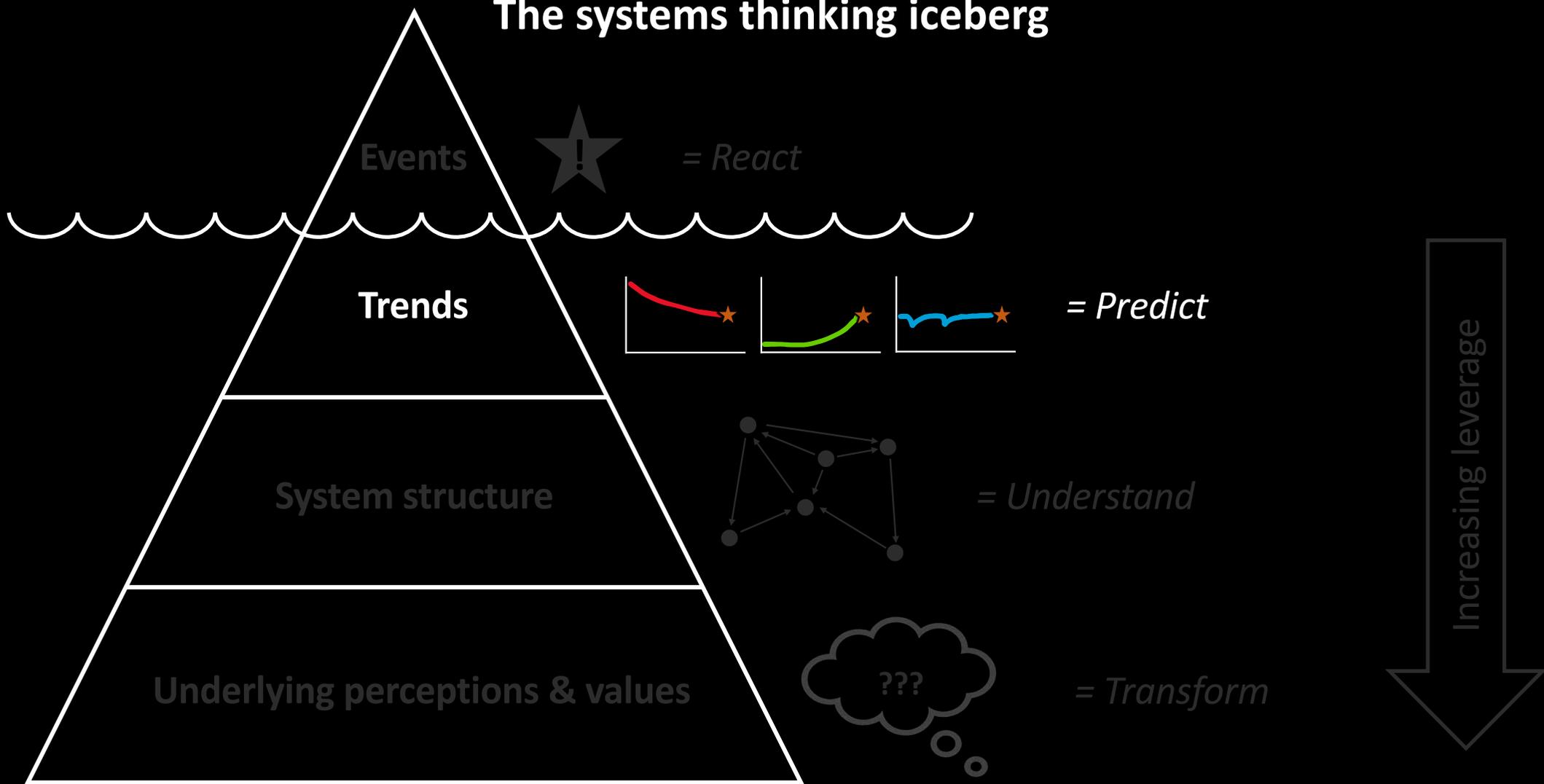
Systems thinking iceberg



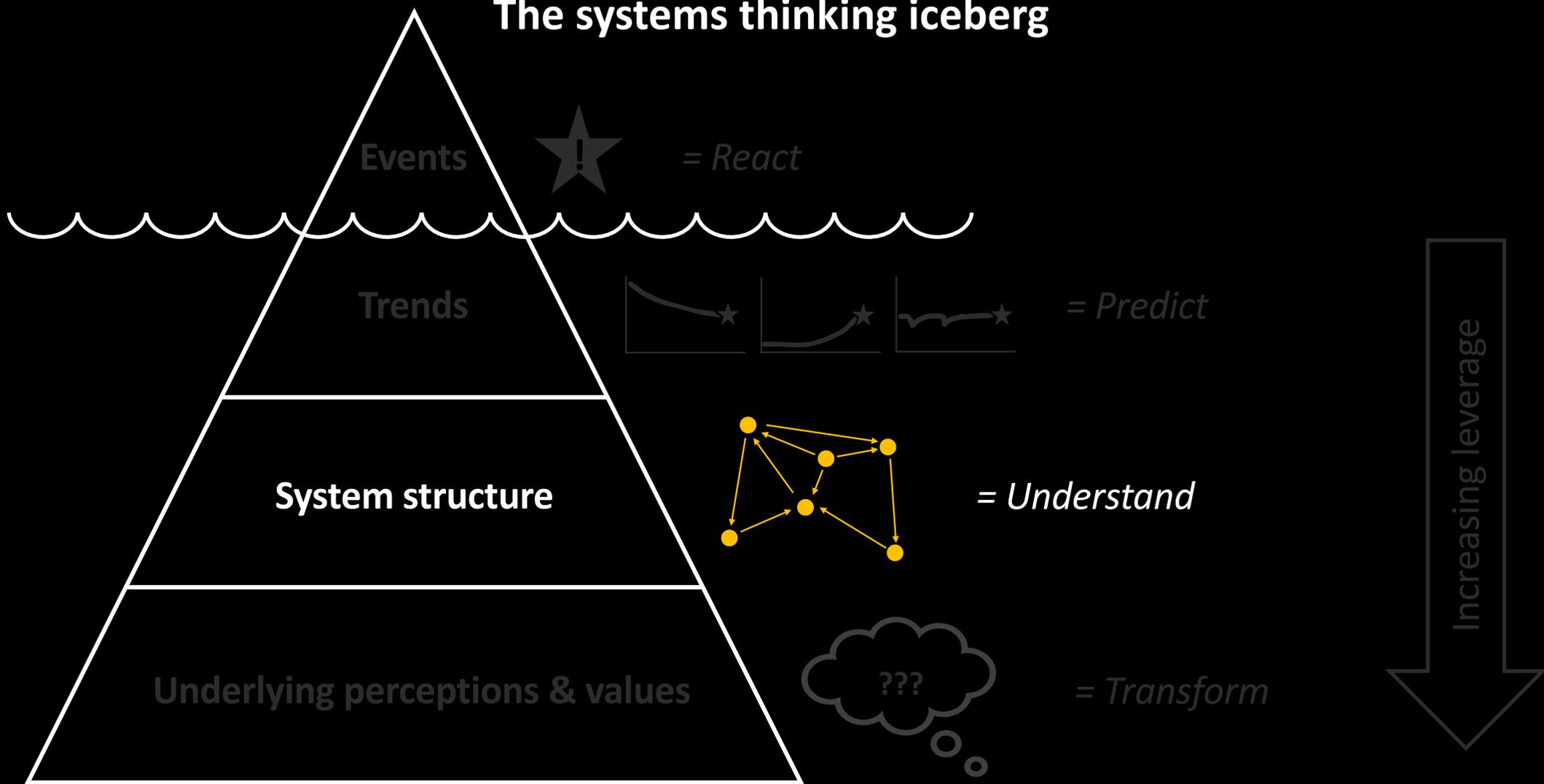
The systems thinking iceberg



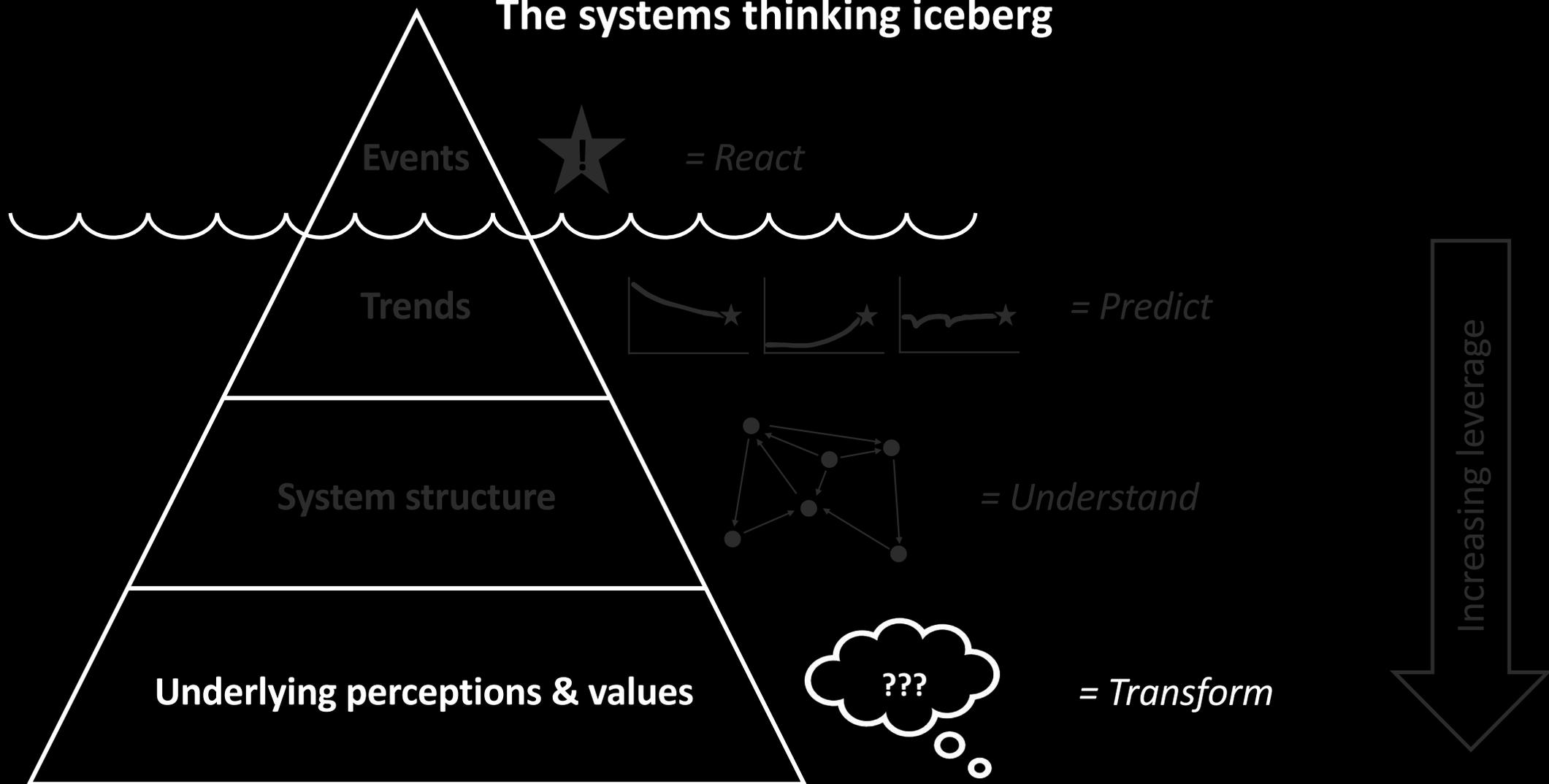
The systems thinking iceberg



The systems thinking iceberg



The systems thinking iceberg



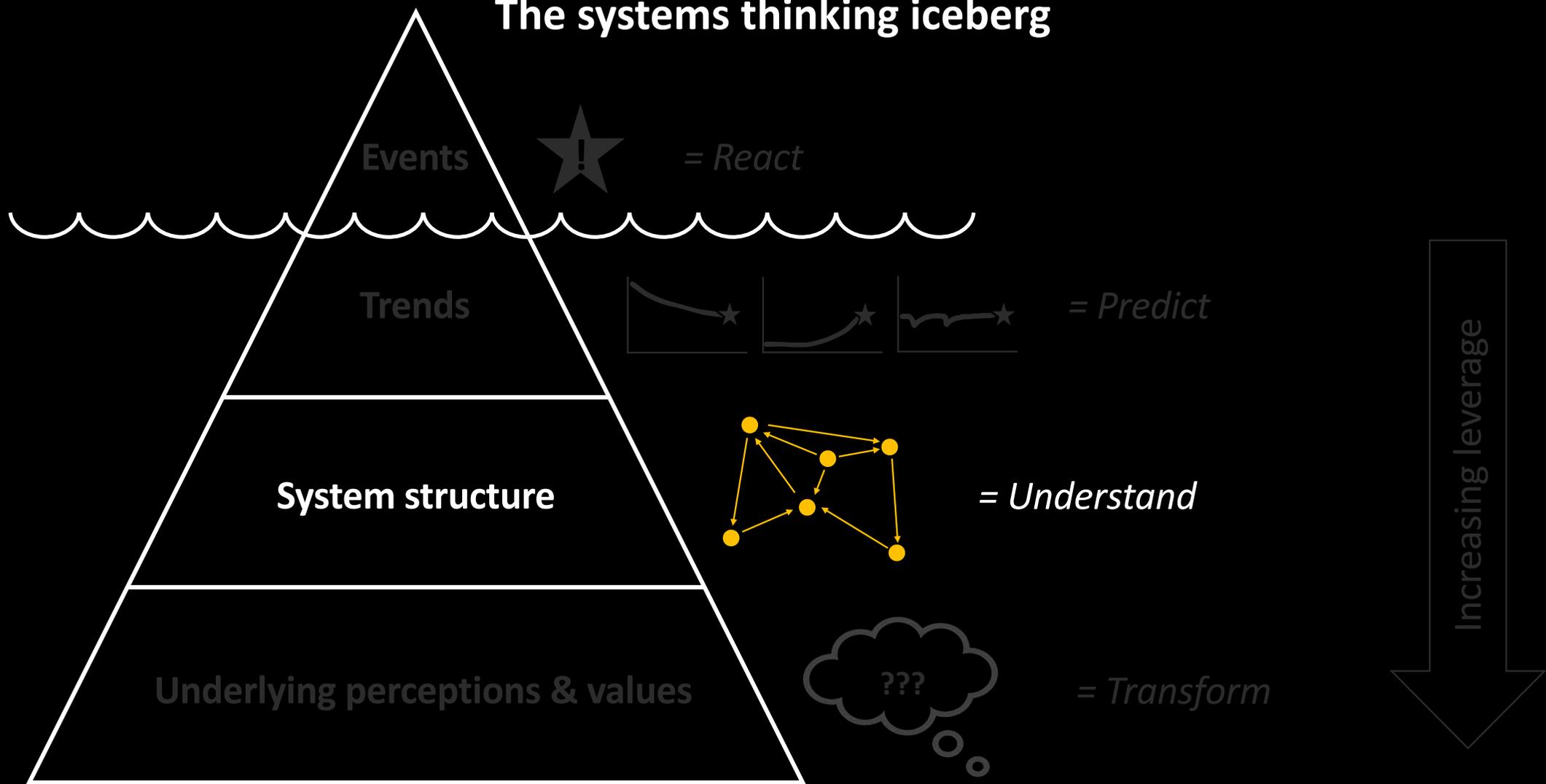
Benefits of systems thinking:

- Problem-oriented analysis. Builds ***understanding of why*** something occurs.
- It seeks to ***synthesise*** information. So is complimentary to ***analysis***. *Is a useful tool by itself or with others.*
- Can be a useful ***participatory tool***. Helps identify who to involve as well as help involve them.
- Can help build ***consensus and support***.

What systems thinking is not:

- A method for ***predicting or forecasting*** specific results
- A ***'magic bullet'*** for solving all problems

The systems thinking iceberg

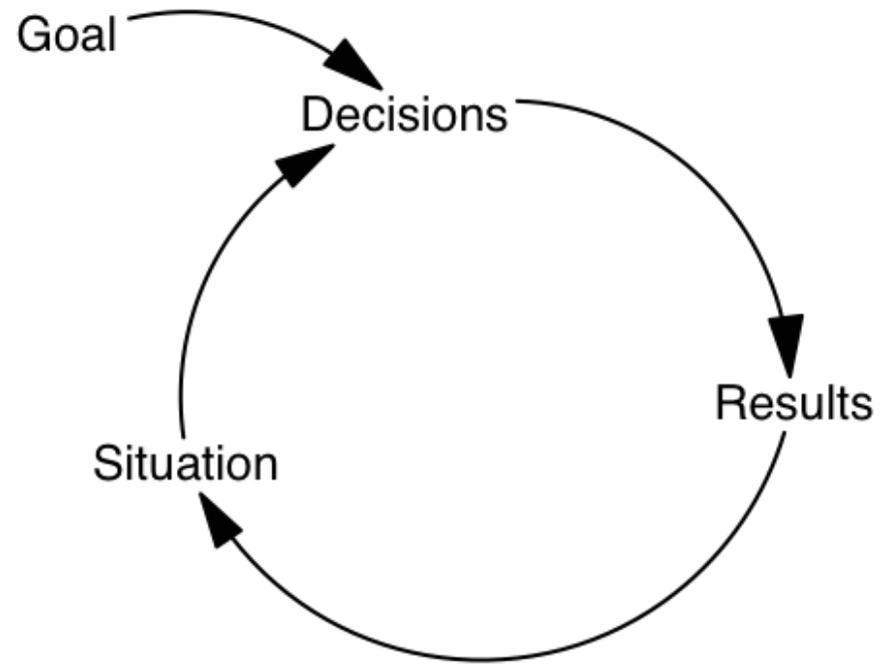
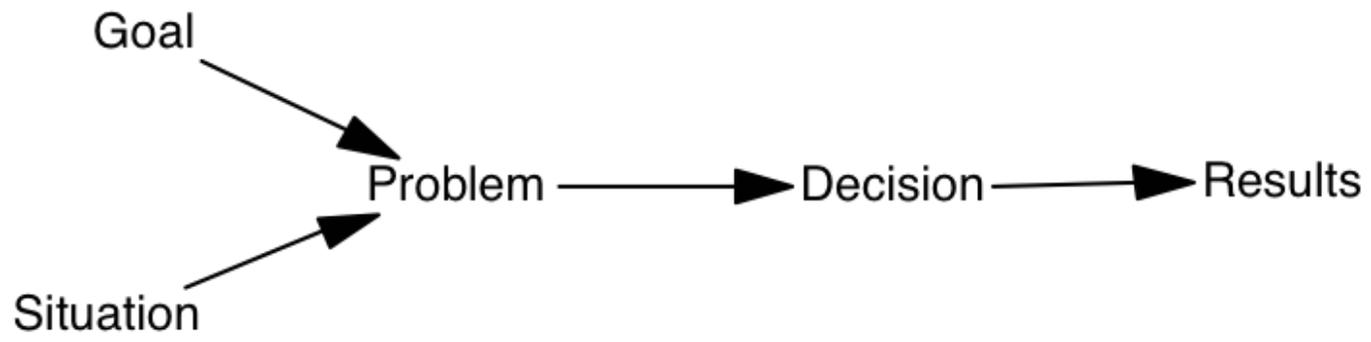


Understanding 'system structure'
helps us understand why a
behaviour over time is occurring.

System structures may have 3 parts:

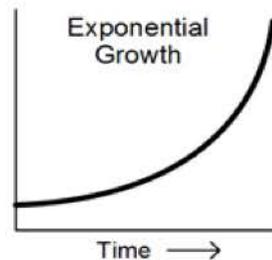
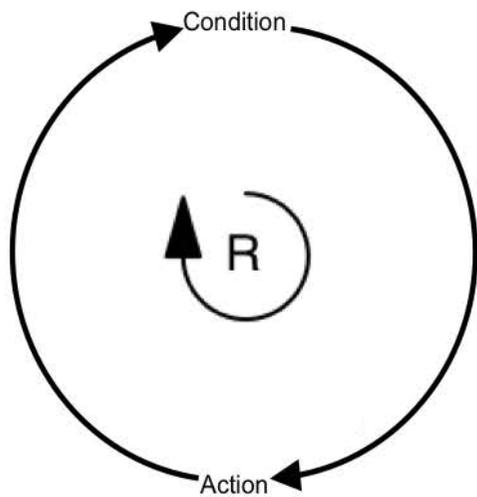
- **Feedback**
- **Delays**
- **Accumulation**

Feedback

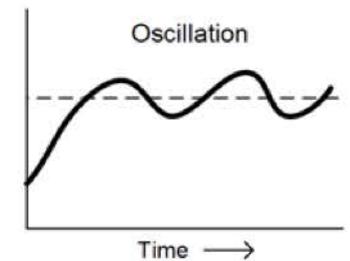
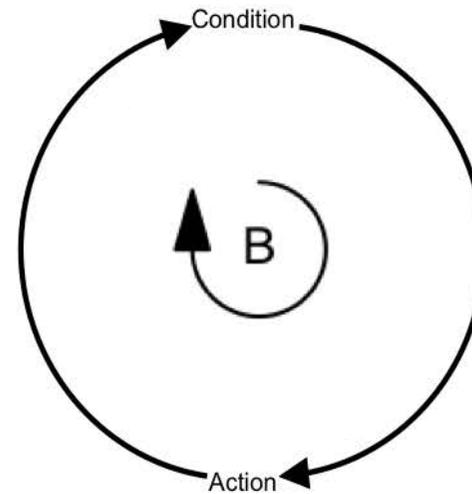


Feedback loops: the basic building blocks of a system diagram

Reinforcing (R) feedback loop

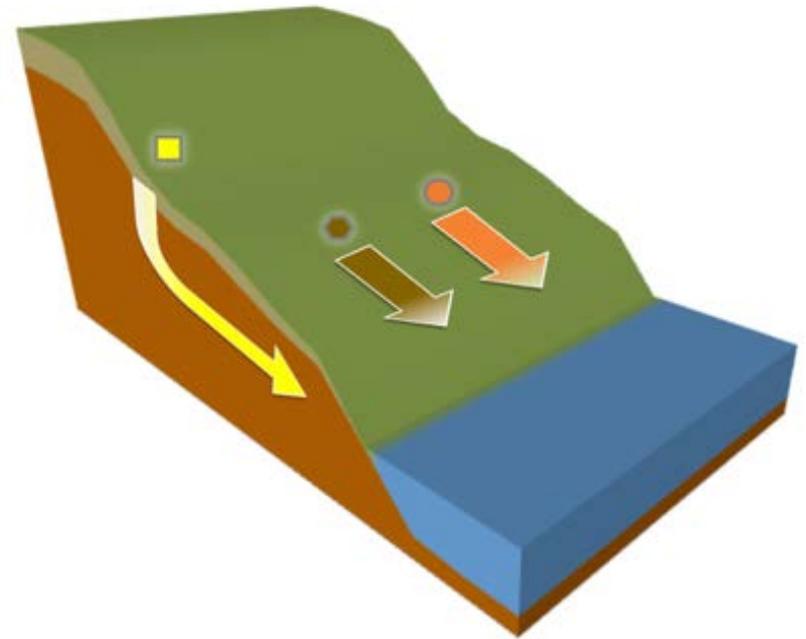
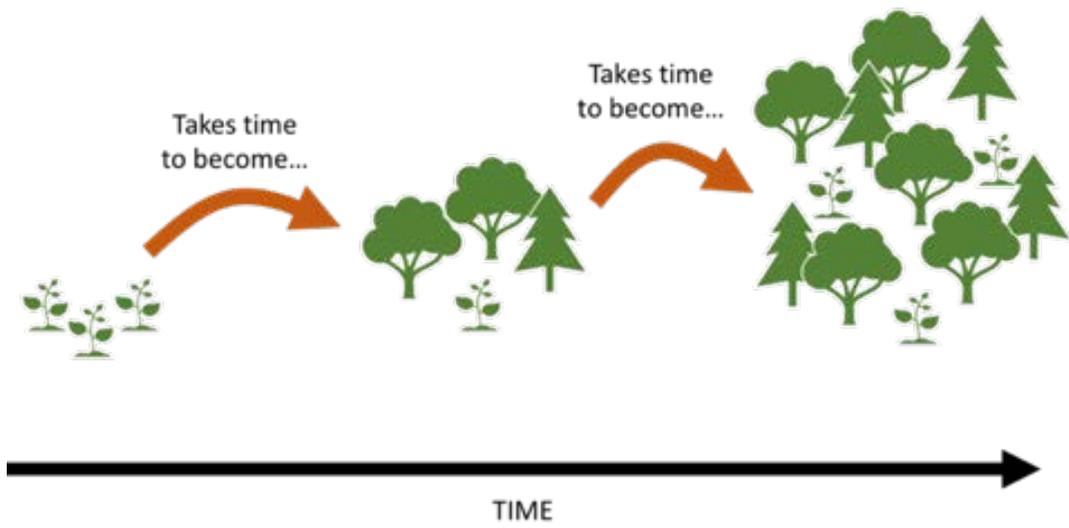
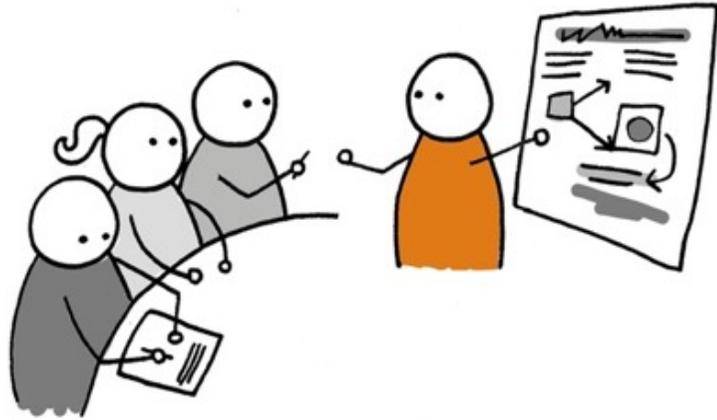


Balancing (B) feedback loop

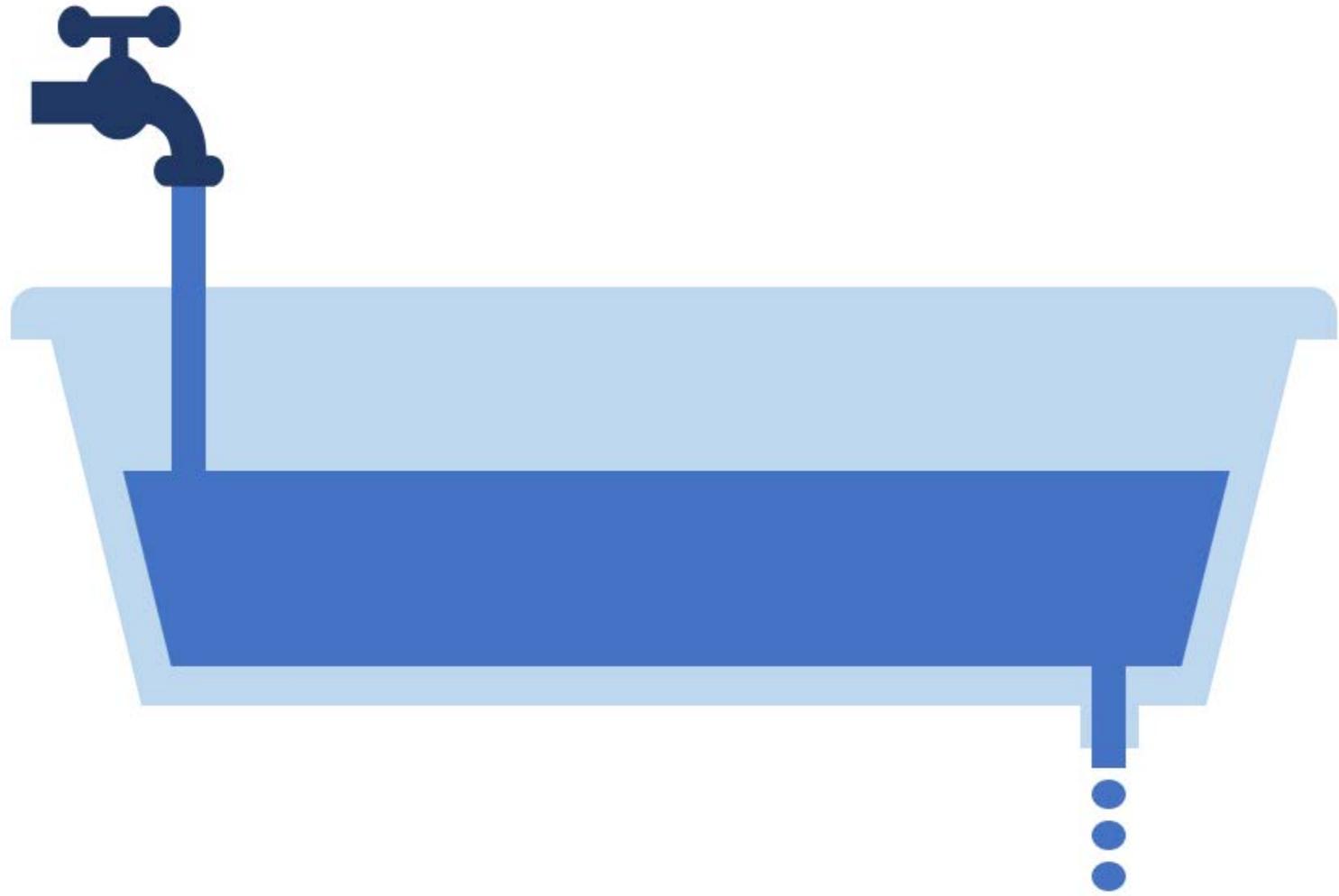


Adapted from Senge (1990) & Ford (2010)

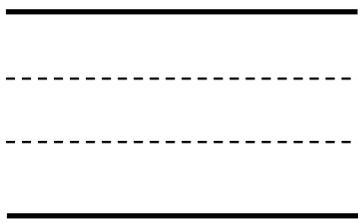
Delays



Accumulation



Example



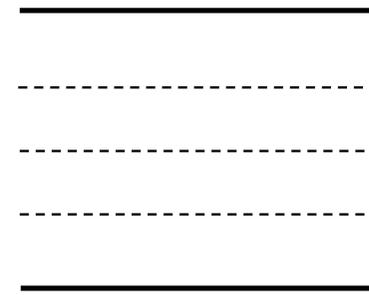
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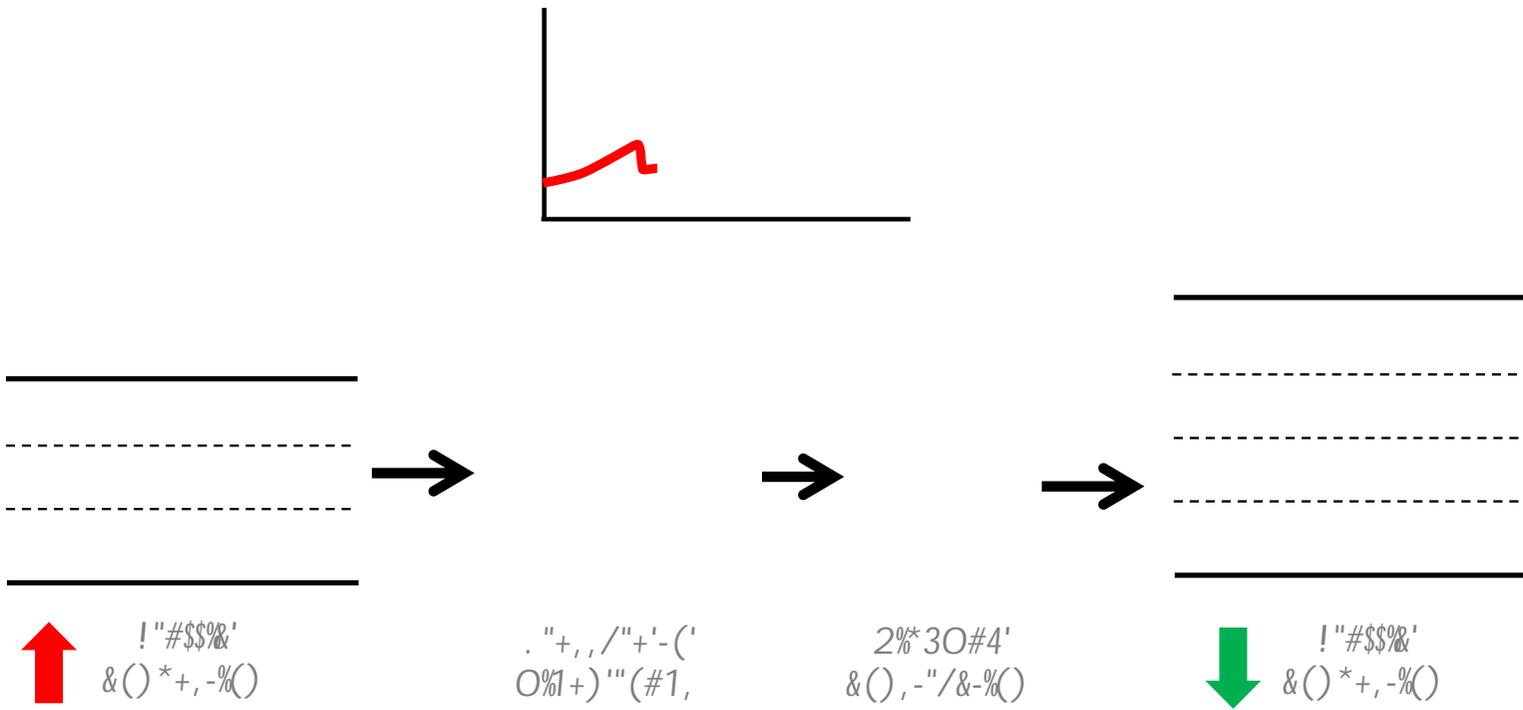
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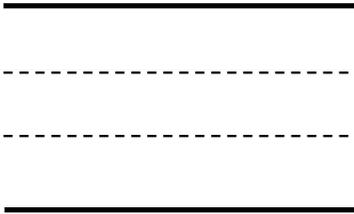


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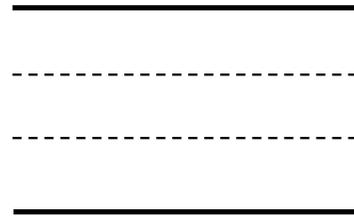
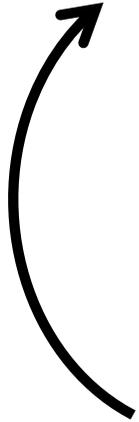




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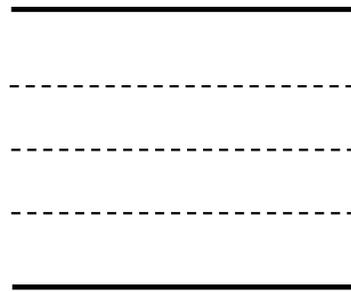
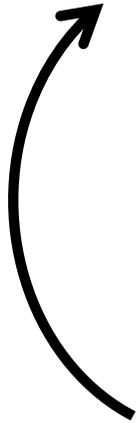
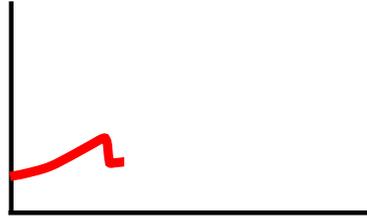


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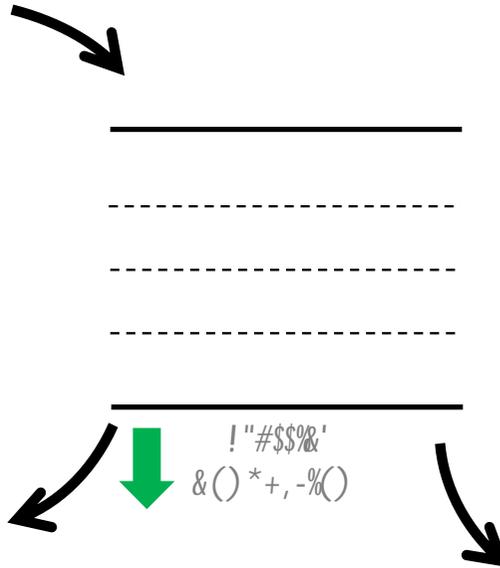
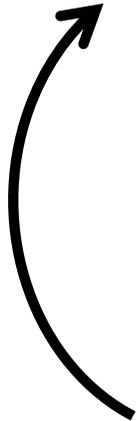
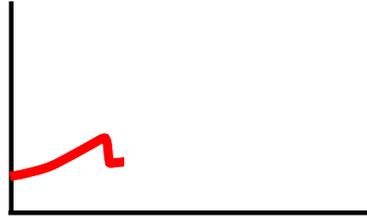
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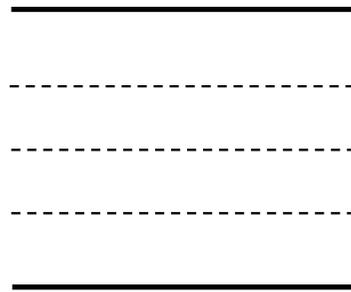
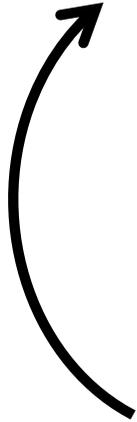
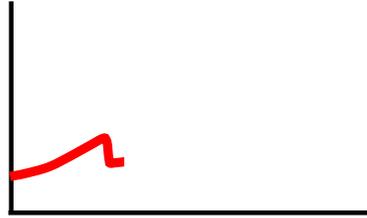
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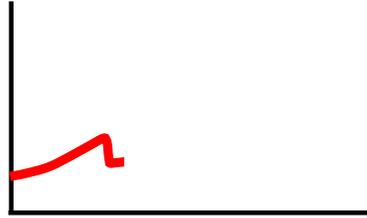
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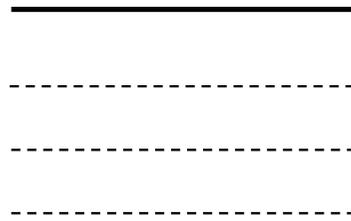
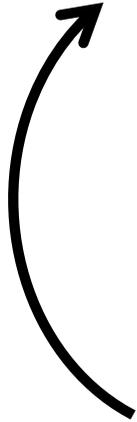
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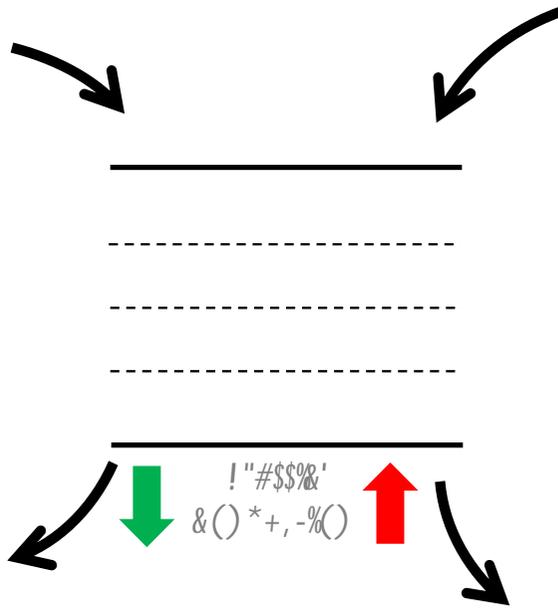
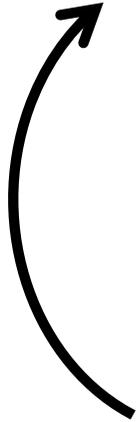
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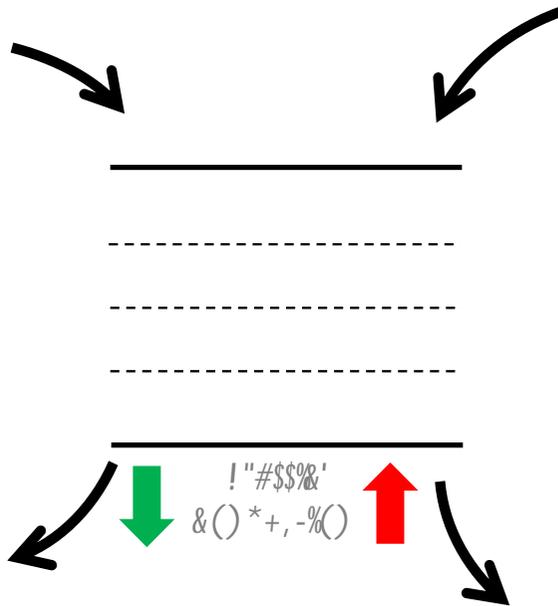
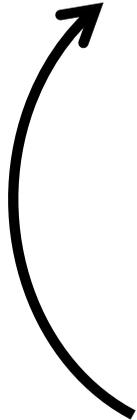
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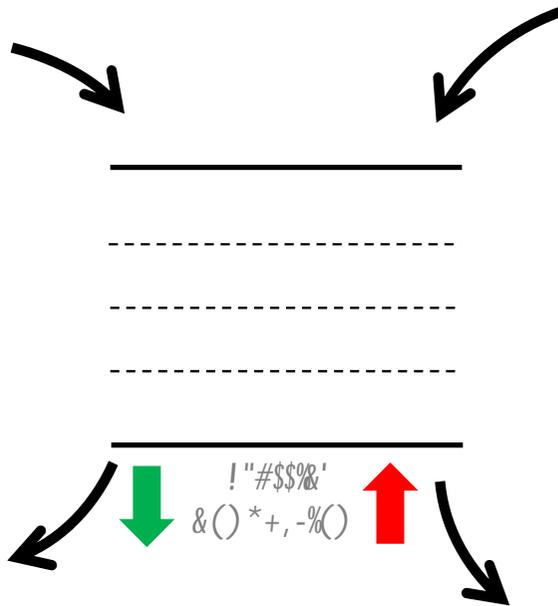
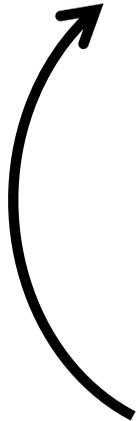
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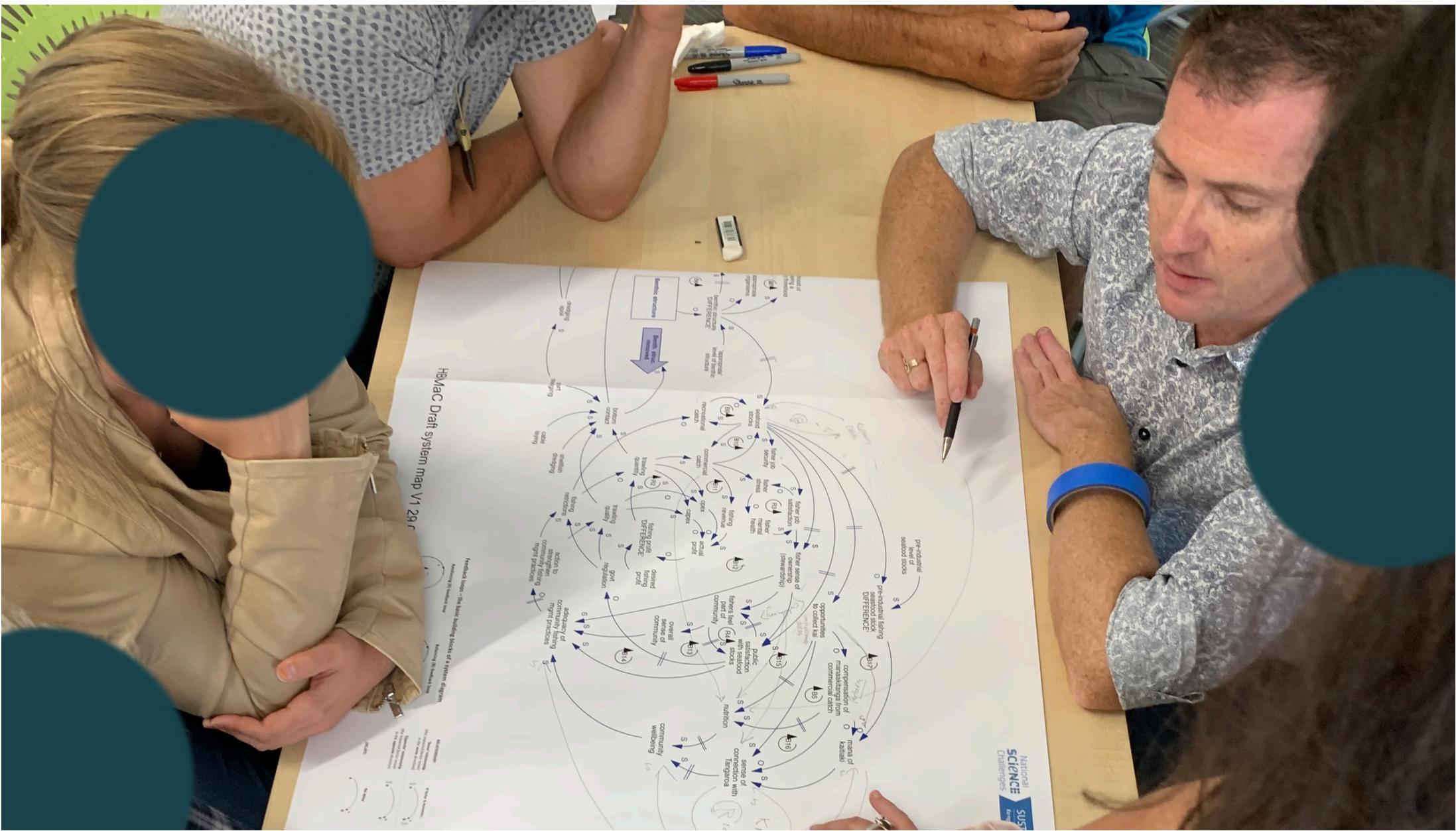


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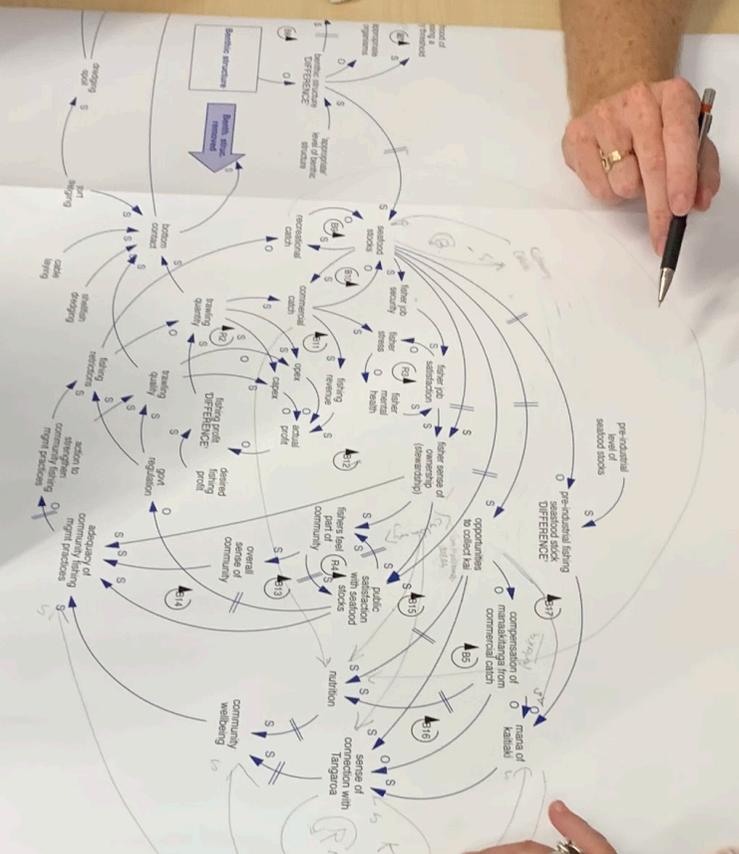
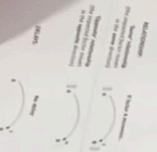
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**Building a picture of system
structure to understand
stressor behaviour
in Hawke's Bay**

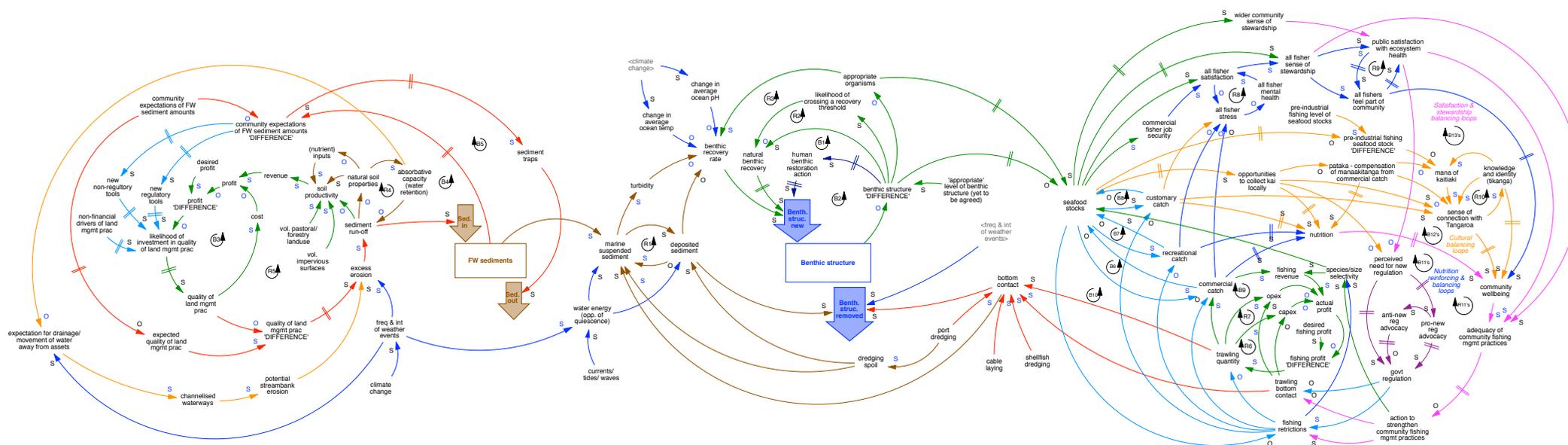


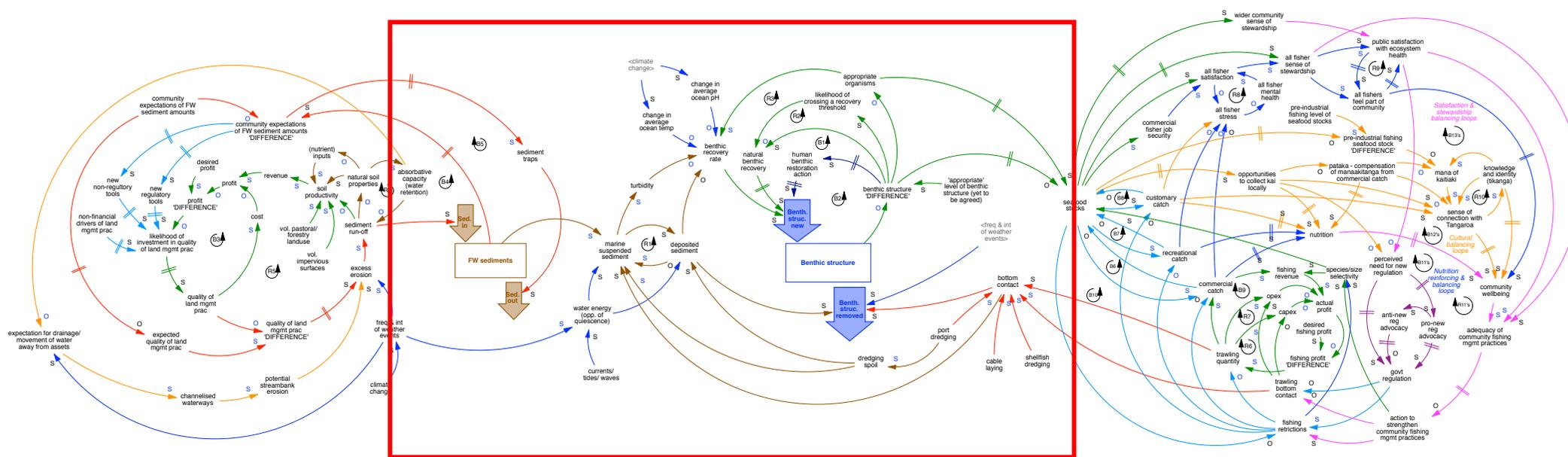
HBMAC Draft system map V1 29r

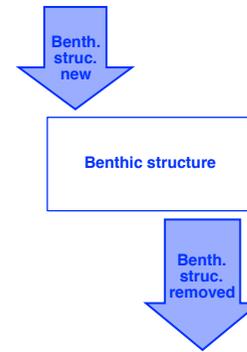
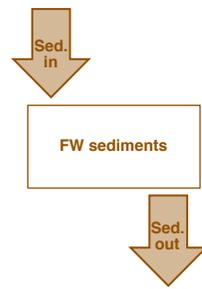
Federated layers - the basic building blocks of a system diagram
According to HBMAC team

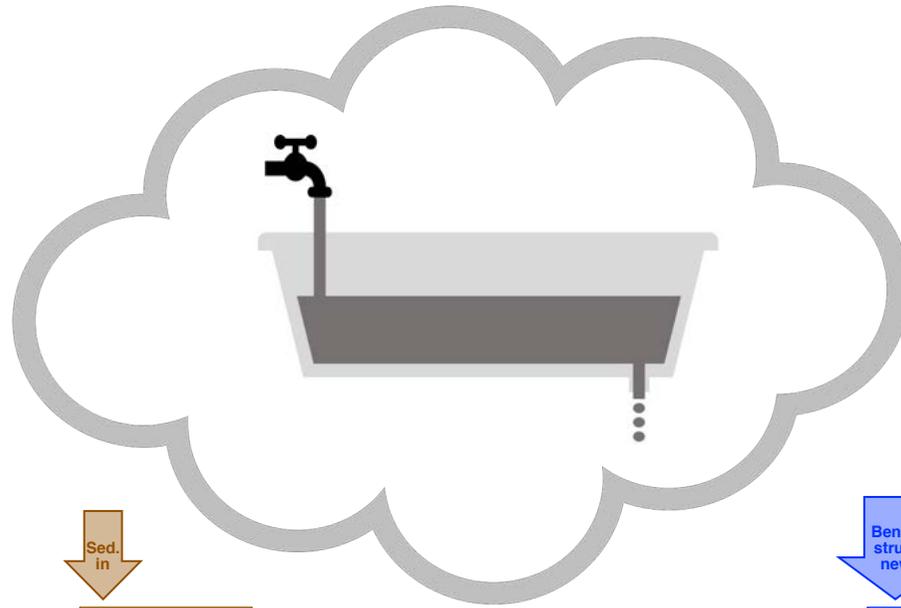


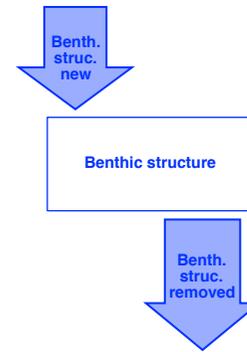
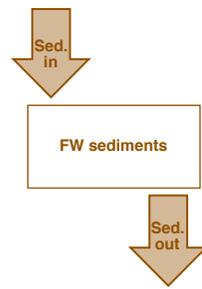
NATIONAL SCIENCE CHALLENGES
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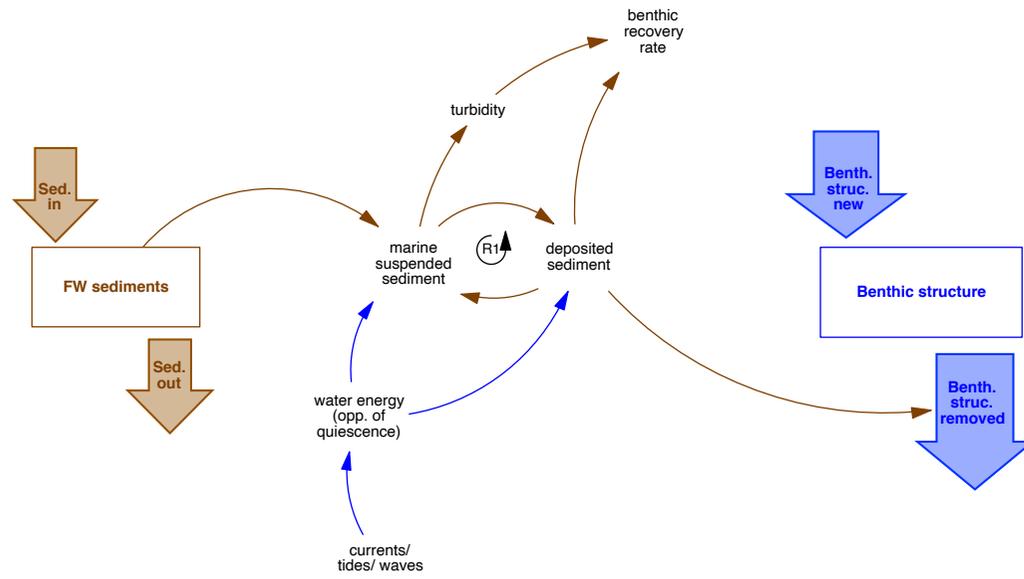


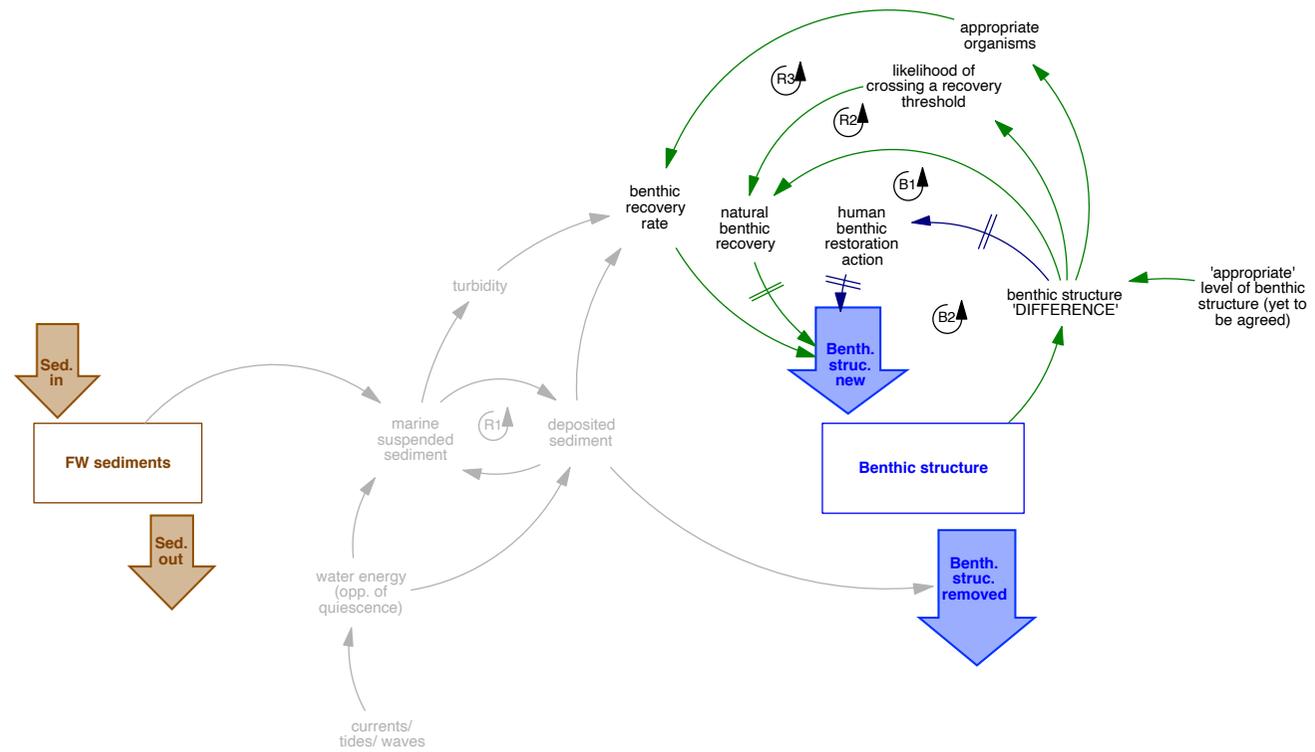


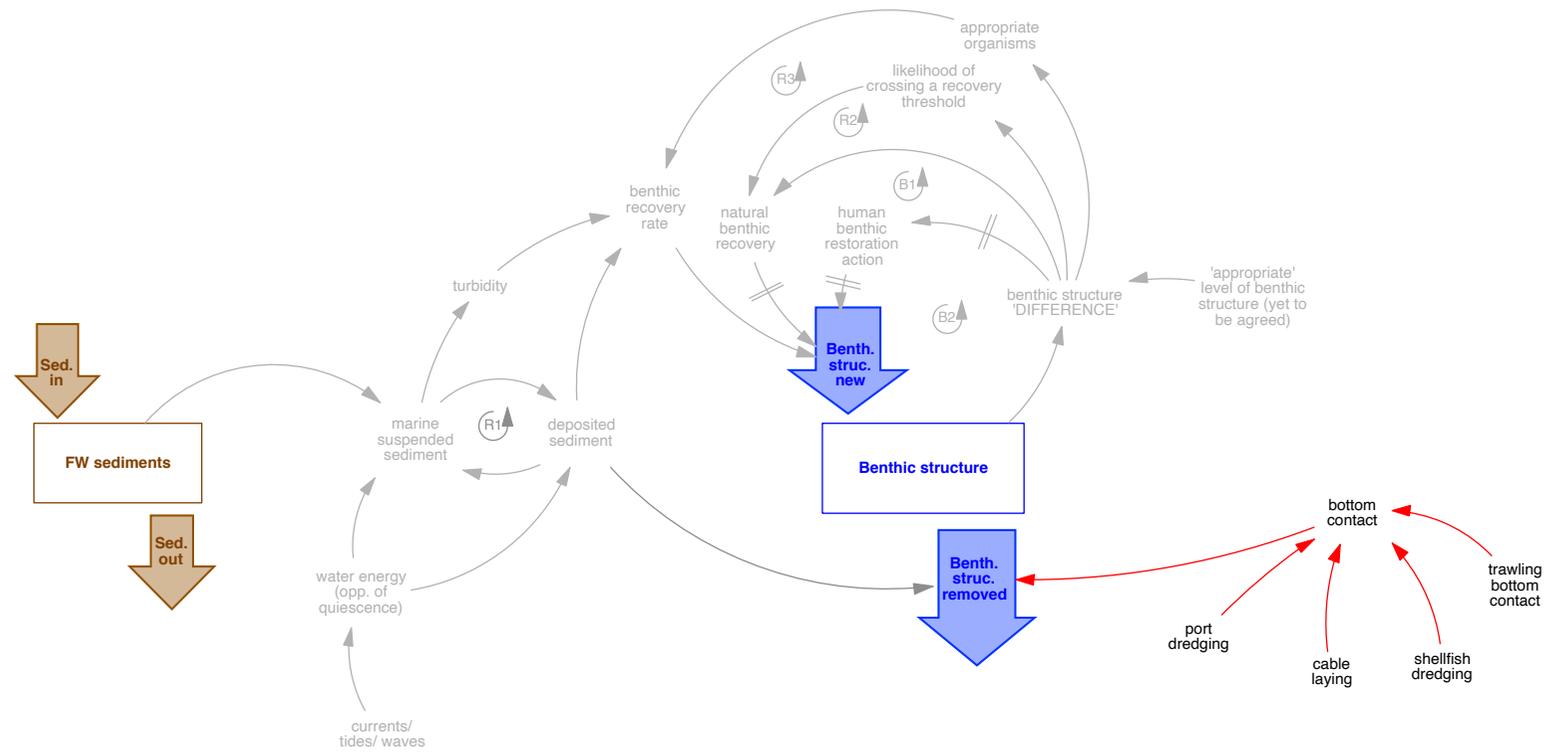


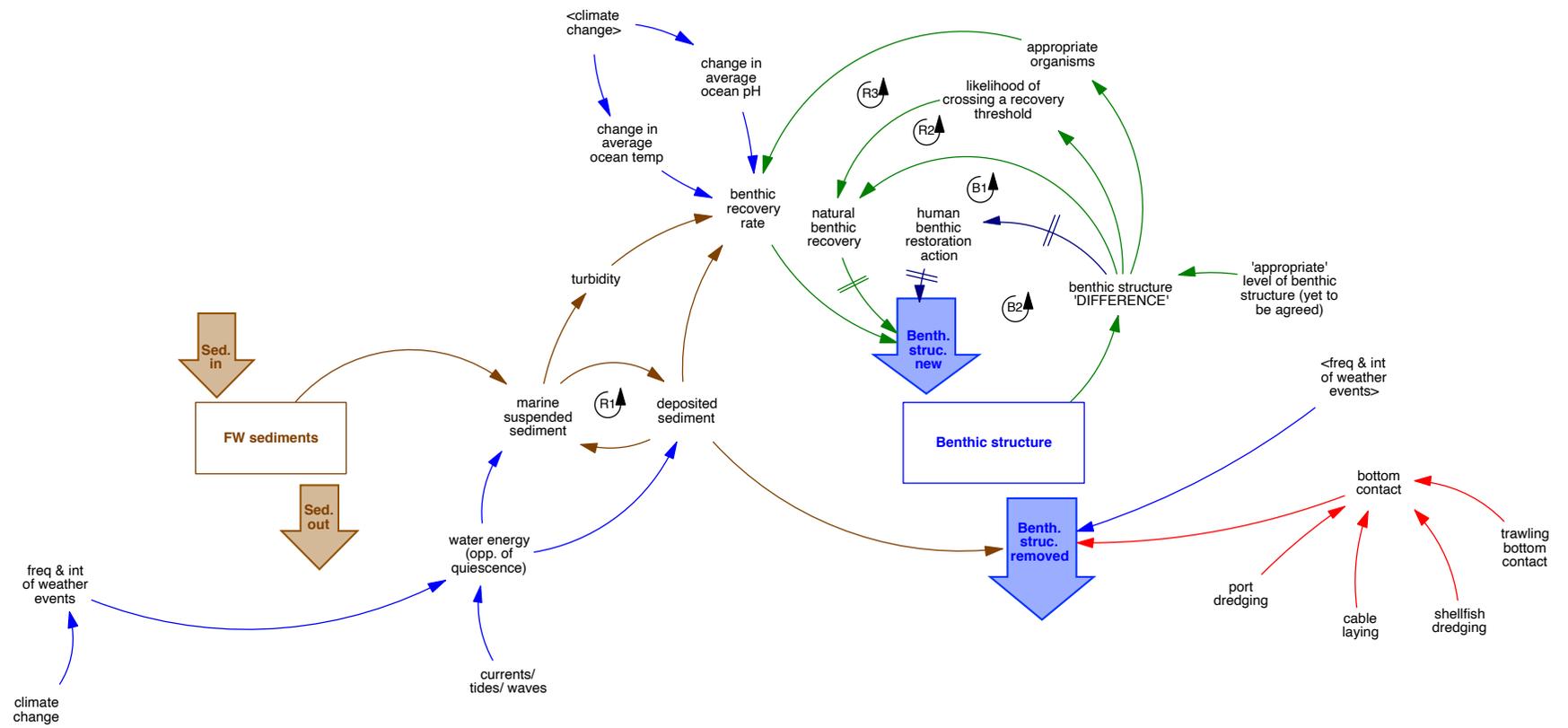












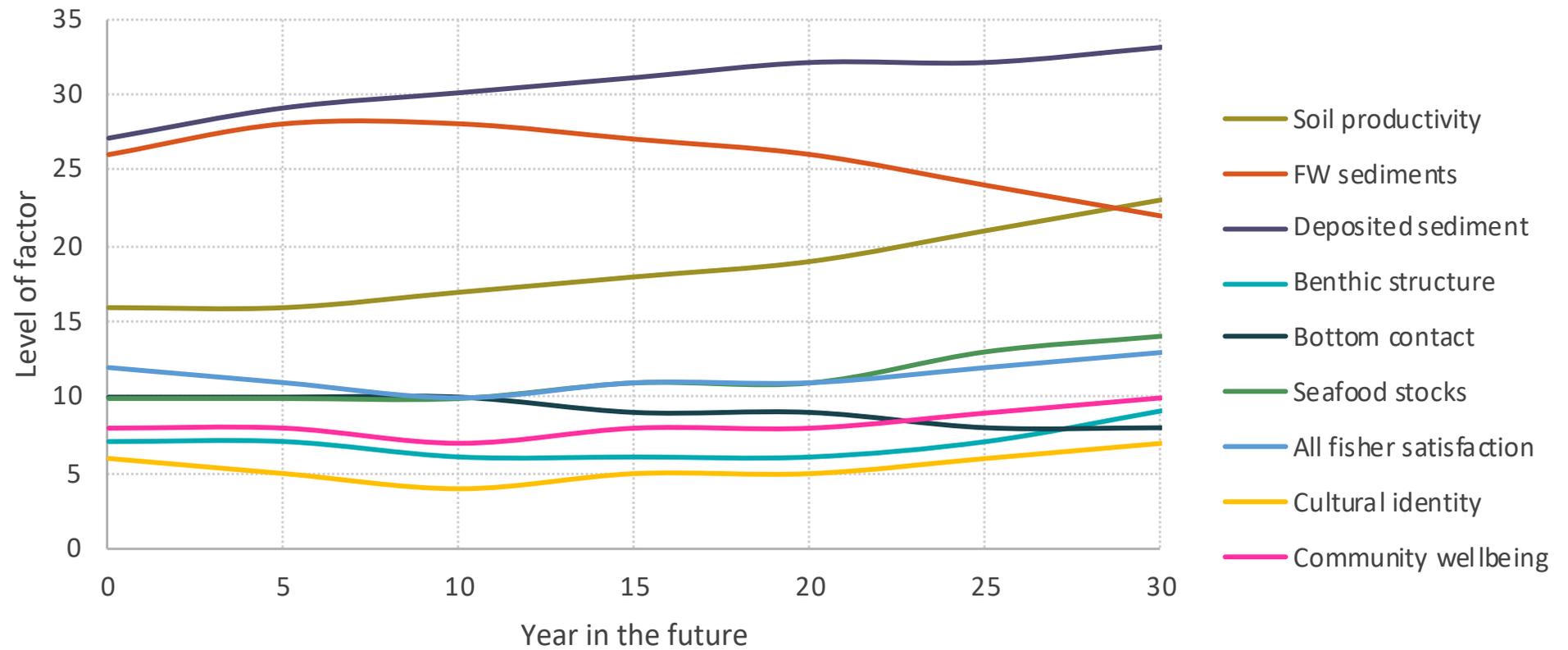
Main areas of imbalance:

- Freshwater sediments
- Benthic structure
- Connection with Tangaroa
- Public satisfaction with ecosystem health

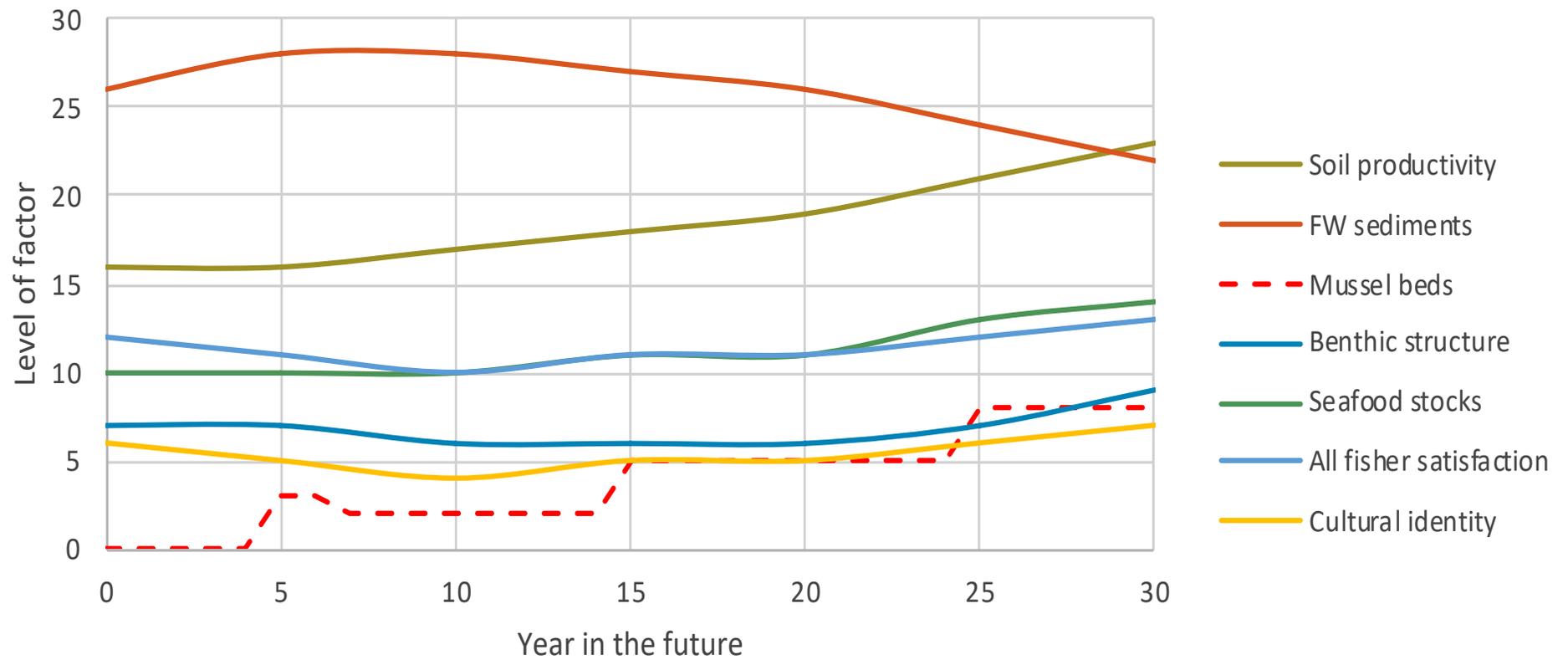
**A fast-track way of
exploring possible
futures**



Analogue simulation - Baseline ('do nothing')

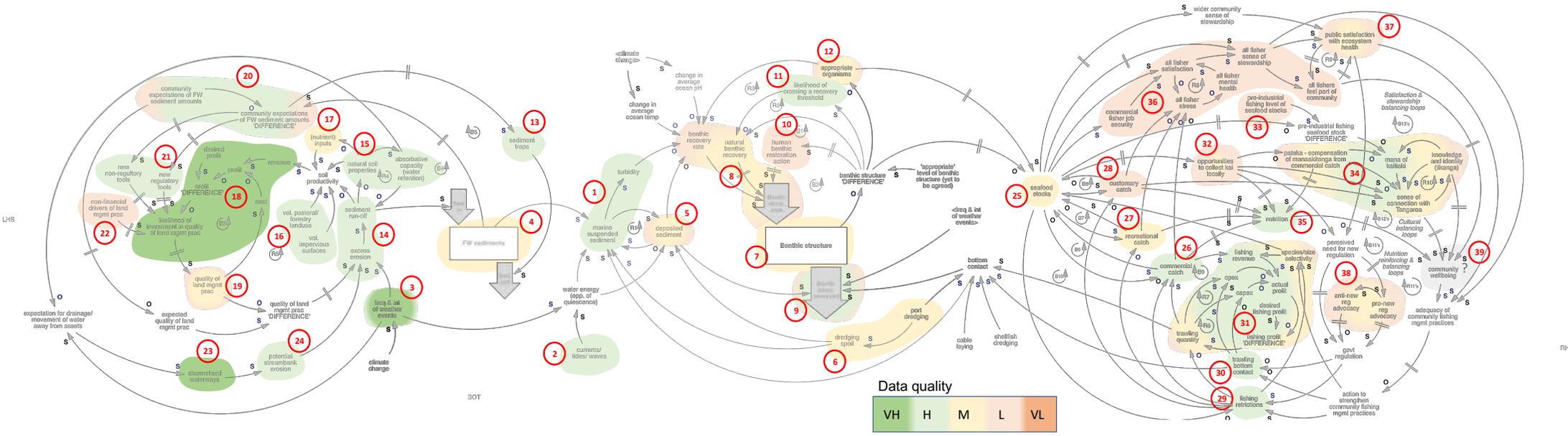


Analogue simulation - Awatoto mussel beds



Knowledge stocktake

Knowledge stocktake



Scaled: Dark green areas plentiful robust data;
 Dark orange areas less plentiful or robust data

Next steps...
(through 2021)

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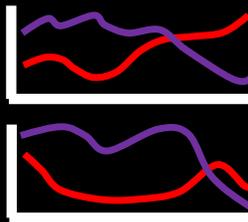
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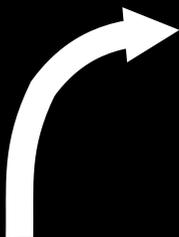
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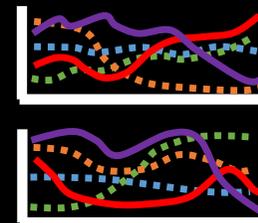
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!"#\$%&'()* * '#++,-'#\$%+'. /#\$\$%

Questions

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