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Land and Water Forum's

Science to Policy Workshop

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Tools enabling system thinking 1.Building knowledge networks and report cards

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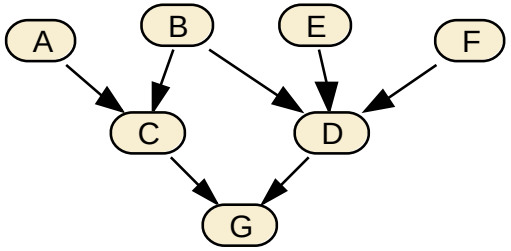
It's complex: Need tools to support shared system understanding

Tools to develop shared understanding

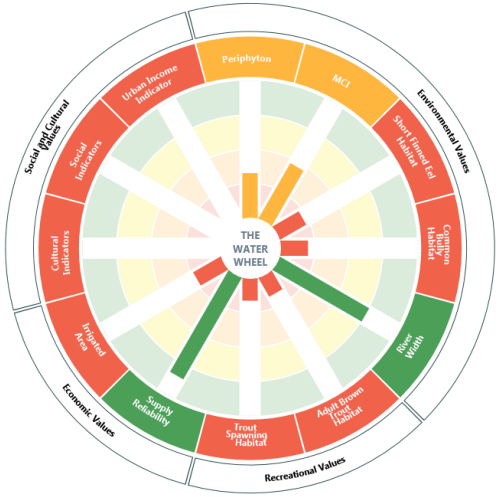
1, Knowledge Networks (KNs) & Causal Loop Diagrams (CLDs)



- shared understanding of how the whole system works
  - Values and links to attributes/indicators
  - Drivers, management options and consequences
  - Waterbody type influences on resilience to pressures

2, Report Cards and Water wheels

- Summarise complex information on state and trends for collaborating stakeholders and the wider public

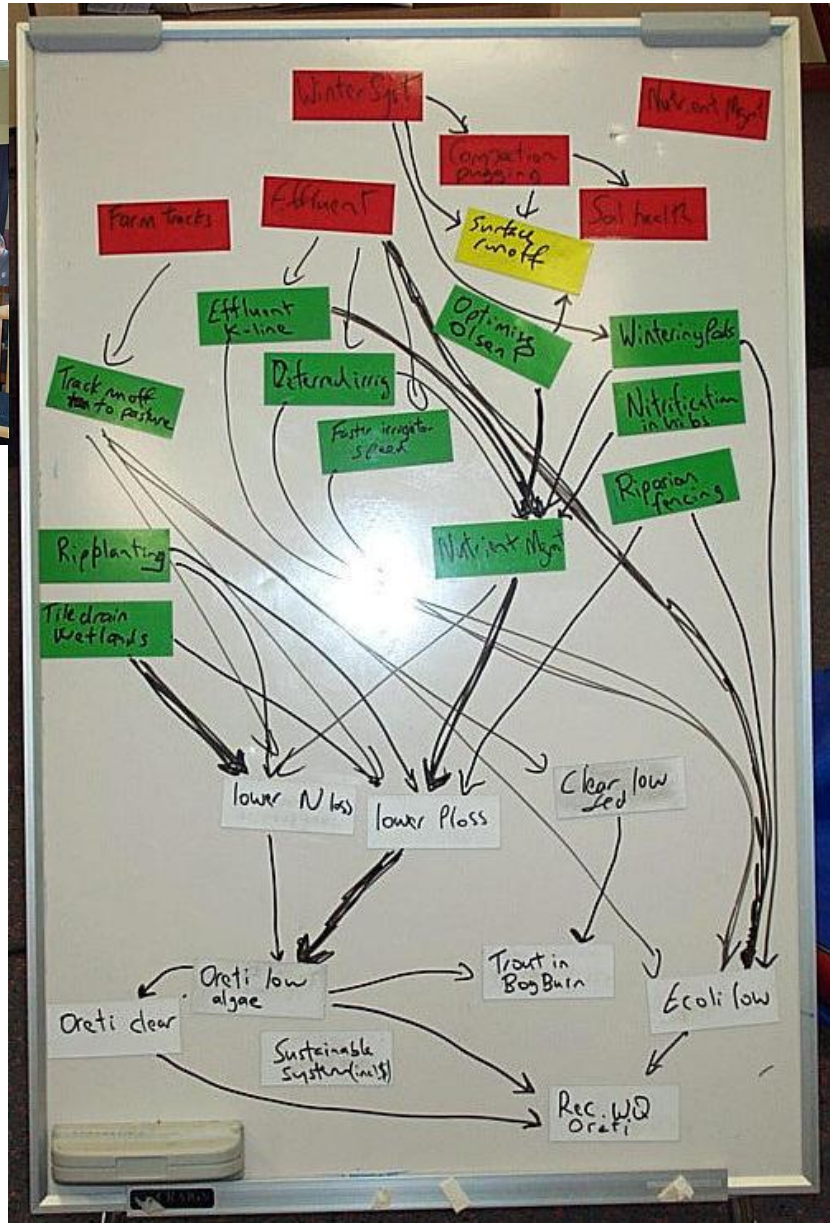


1, Knowledge Networks (KNs) & Causal Loop Diagrams (CLDs)

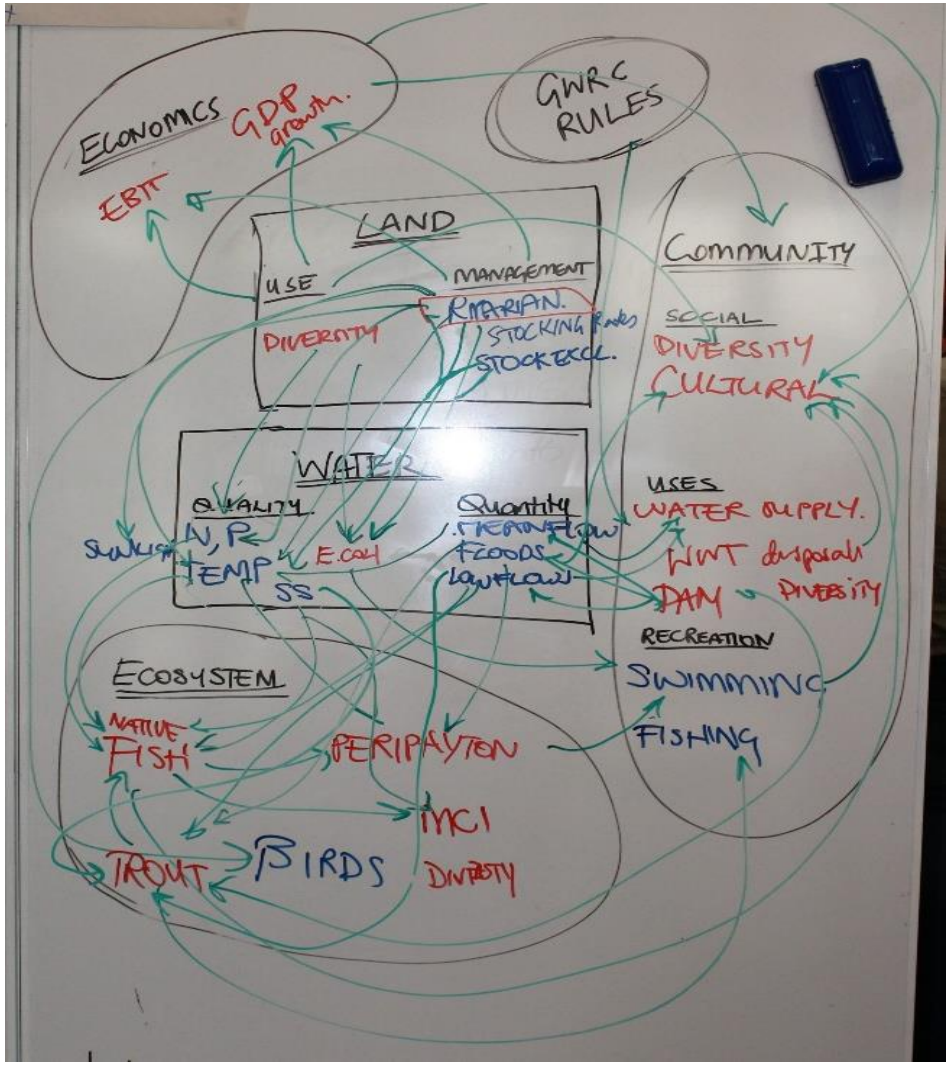
- Summarise collective understanding of system on 1 page
  - KNs: emphasise unidirectional **cause and effects**
  - CLDs: emphasise **feedbacks**
- Ideally developed by group to enhance collective learning and **ownership**
- Make complexity transparent *en route* to **simplification**
  - Selecting values & attributes/indicators
  - Scoping mitigations/management focus areas
  - Make apparent value conflicts and win:wins - identify potential solutions
- Focus questions for predictive modelling/scenarios

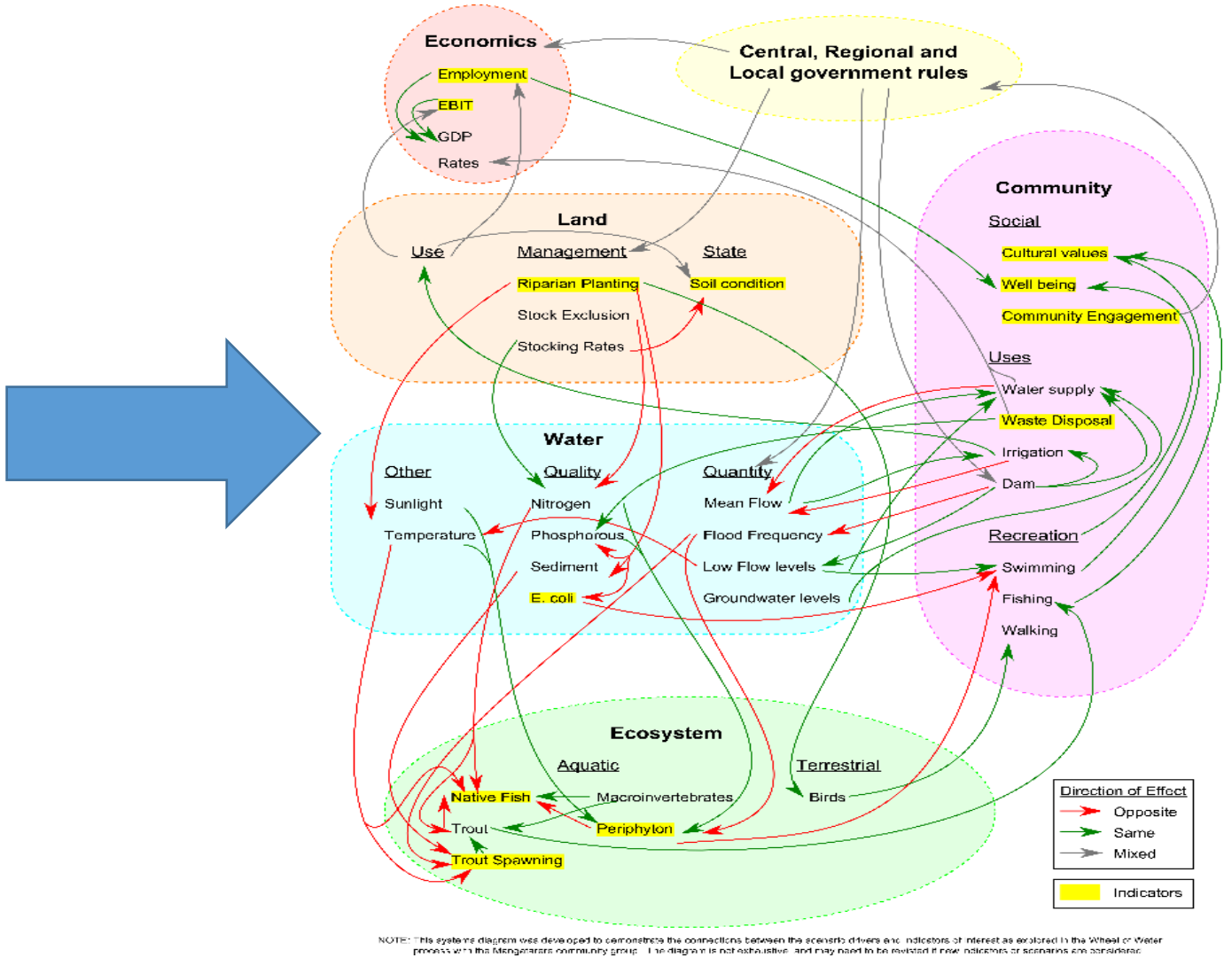
NZ examples of KN/CLD use

- 5 Dairy best practice catchments
  - Management roadmaps for contrasting geographies
- Hurunui
  - causal loop (broad scoping)
  - KN + Bayesian Network (predictive)
- Mangaterere:
  - causal loop + KN (broad scoping)
- Waikato/Waipa KNs:
  - incorporating Maori indicators & VM
  - underpinning report cards



Stakeholder KN: Mangatarere - Ruamahanga



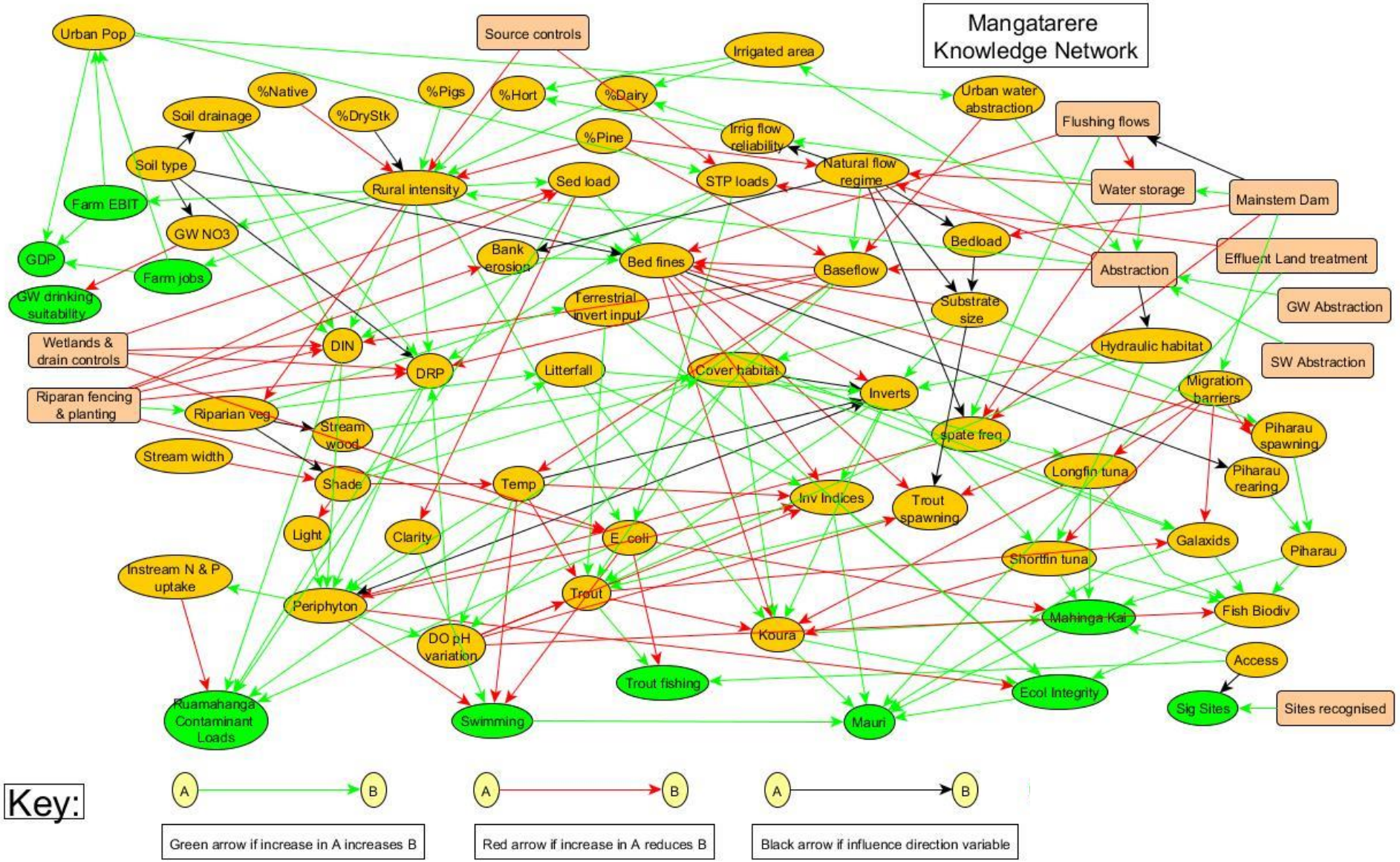


yEd graph – "expert" derived

Actions

Drivers & attributes

Values

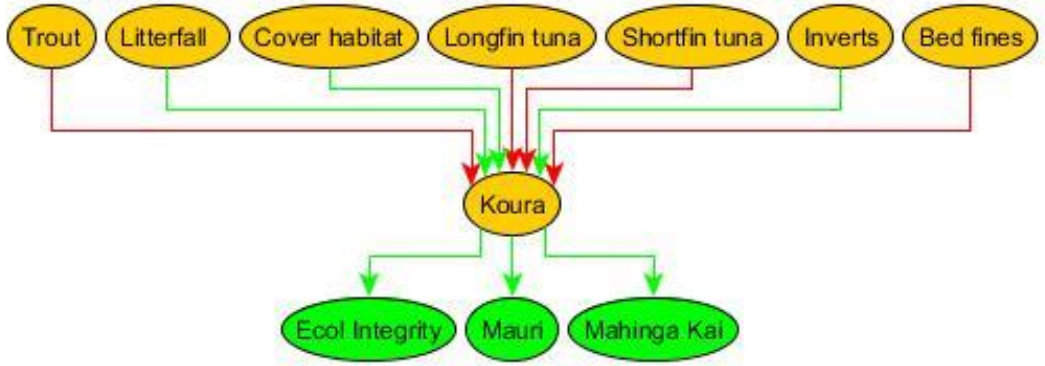


yEd's various views help stakeholder exploration of KN

"Neighbour" view summarise direct linkages: e.g. Koura

Drivers & attributes

Values



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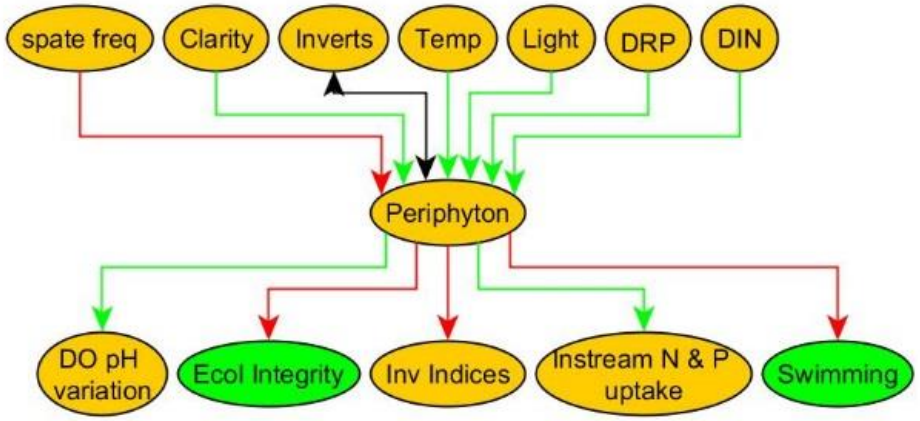
“Neighbour” view – Periphyton:
Proximal causes and effects

Drivers & attributes

Values

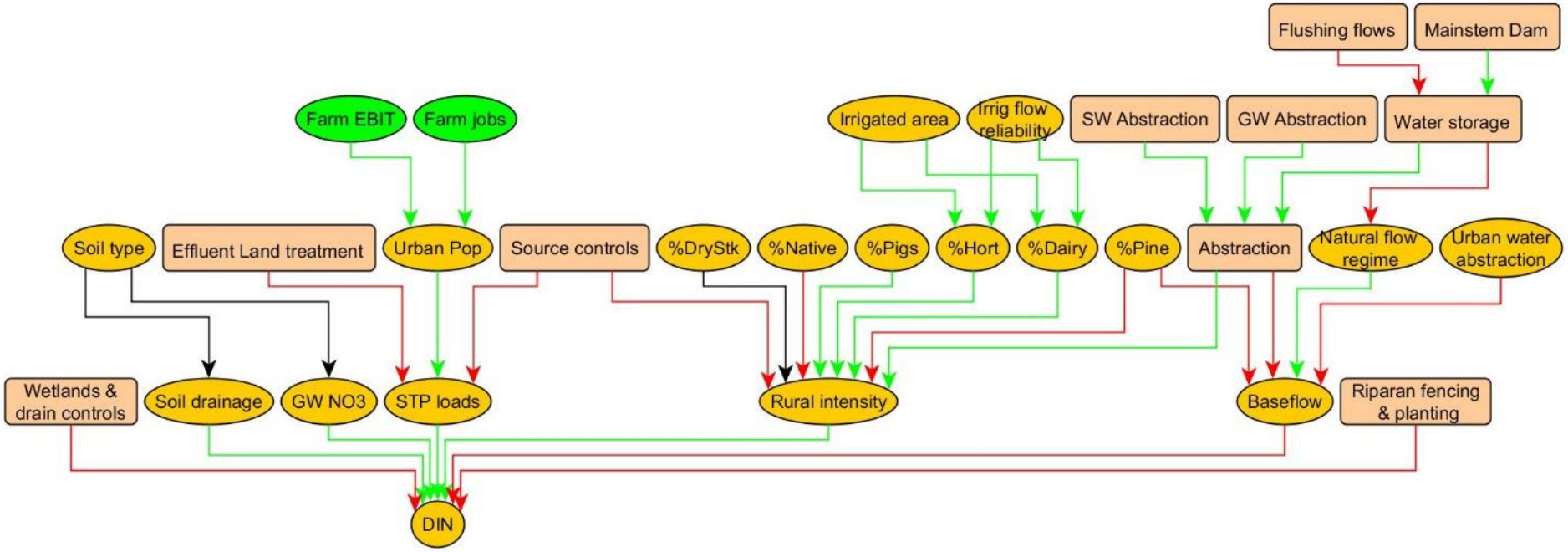


“Predecessor” view e.g. influences on DIN (Dissolved Inorganic N)

Actions

Drivers & attributes

Values



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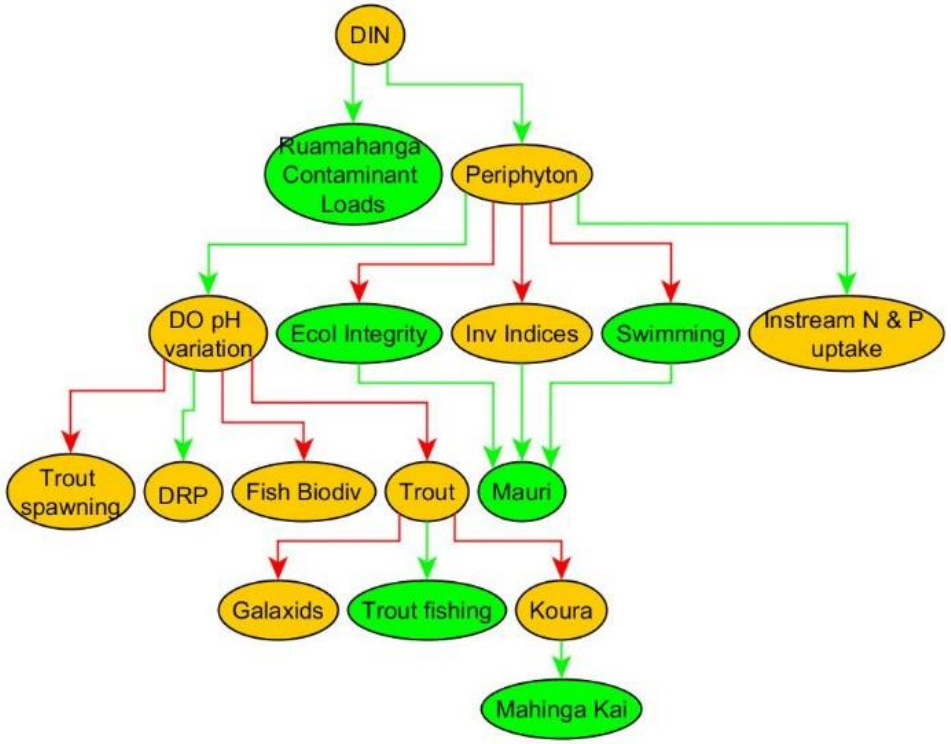
“Successor” view e.g. influences on DIN

Drivers & attributes

Values



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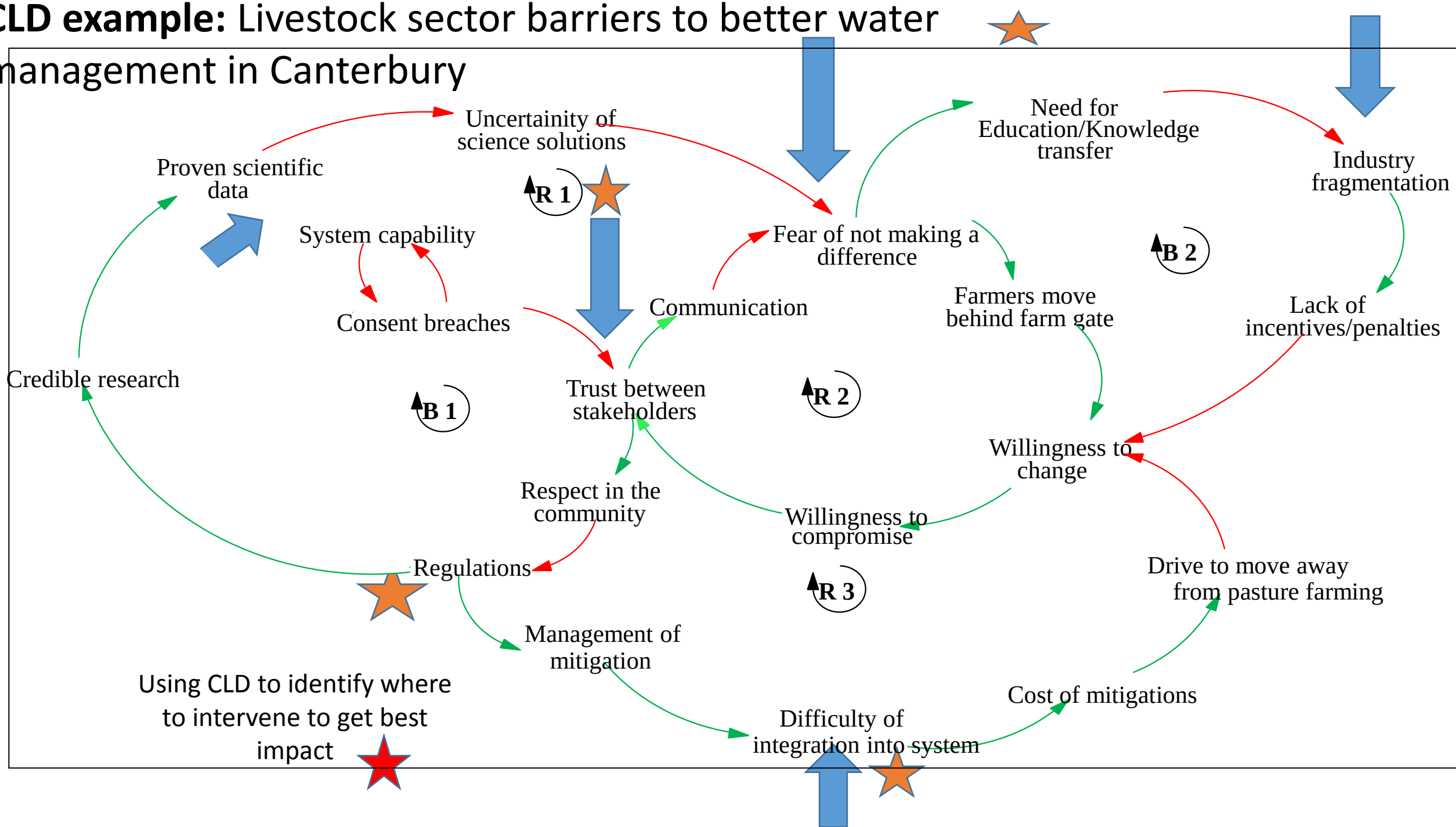
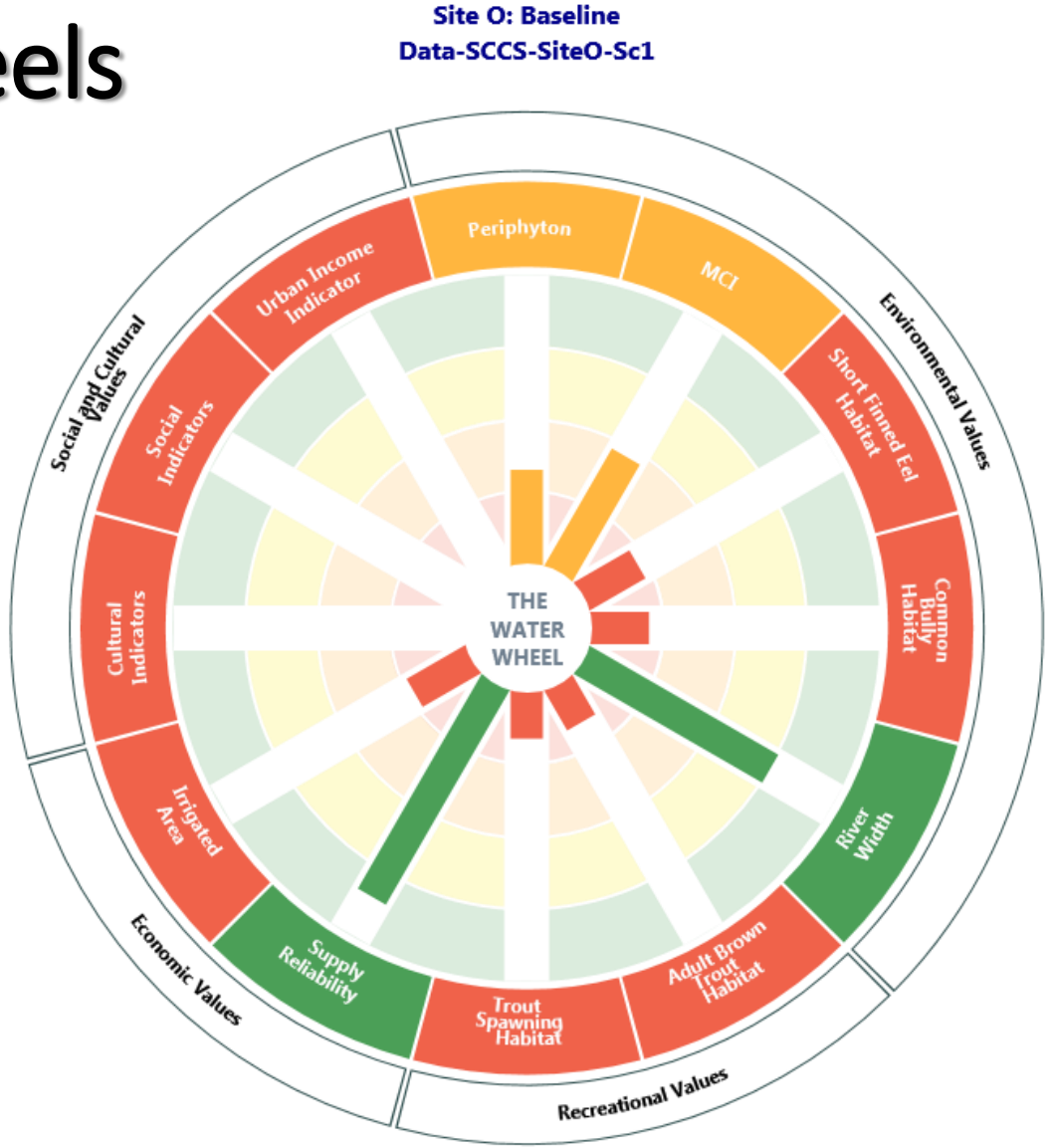
CLD example: Livestock sector barriers to better water management in Canterbury

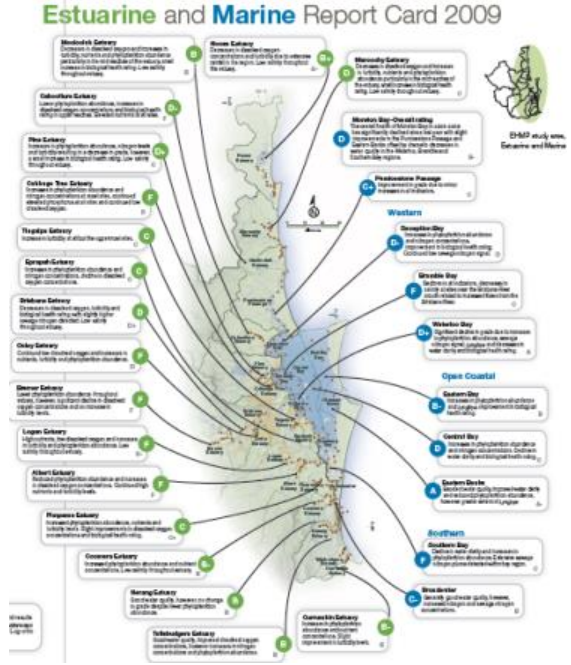


2. Tools to summarise state and trends:
Report Cards and Water Wheels



Report cards:

- *Synthesise* large amounts of data into simple messages
- Use *Educational report cards* are a common experience (A to F easy to understand)
- Spatial display creates *peer pressure*
  - a powerful human motivator for action
- International examples…
  - Australia (Moreton Bay, Gippsland Lakes, Great Barrier Reef)
  - United States (Chesapeake Bay, San Francisco Bay)
  - Papua New Guinea (Strickland River)



A **Excellent:** Conditions meet all set ecosystem health values; all key processes are functional and all critical habitats are in near pristine condition.

B **Good:** Conditions meet all set ecosystem health values in most of the reporting region; most key processes are functional and most critical habitats are intact.

C **Fair:** Conditions meet some of the set ecosystem health values in most of the reporting region; some key processes are functional and some critical habitats are impacted.

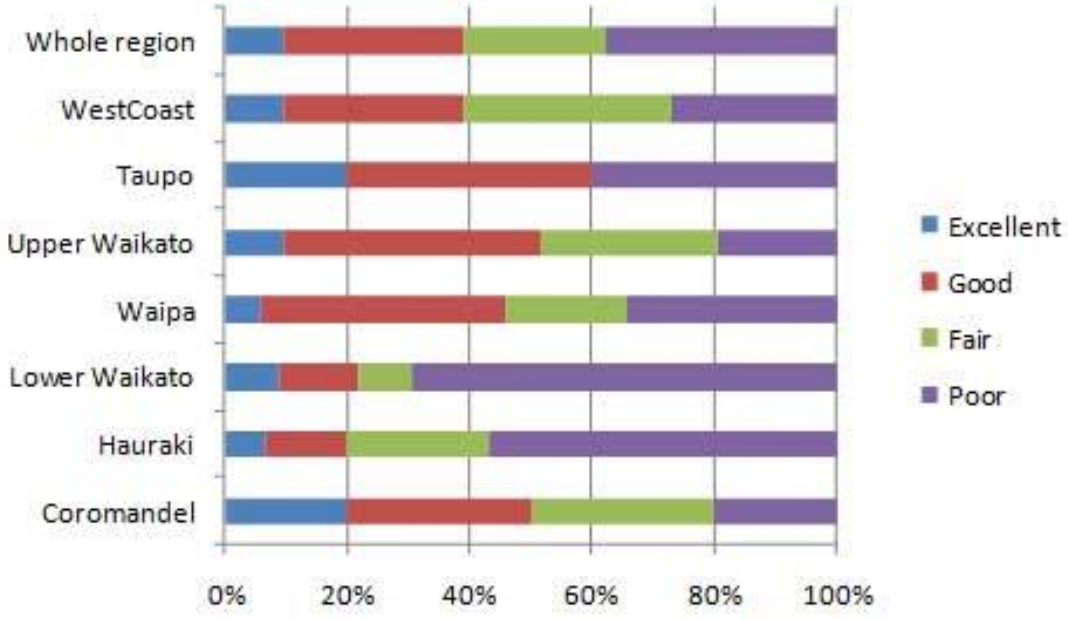
D **Poor:** Conditions are unlikely to meet set ecosystem health values in most of the reporting region; many key processes are not functional and many critical habitats are impacted.

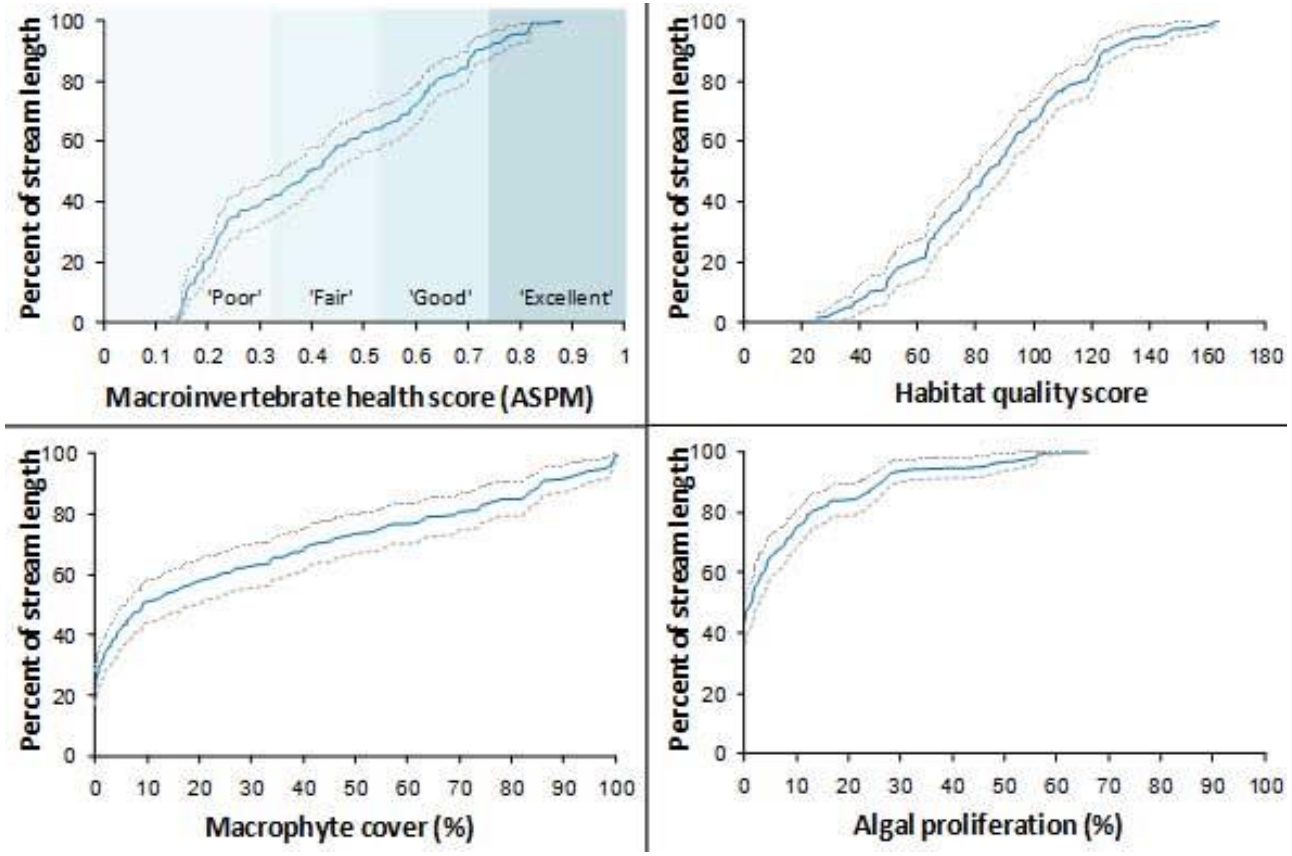
F **Fail:** Conditions do not meet set ecosystem health values; most key processes are not functional and most critical habitats are severely impacted.

Report Cards elements widely used by Regional Councils

-But focus on individual attributes

-Don’t give integrative messages





Macroinvertebrate health score ratings - Waikato subregions

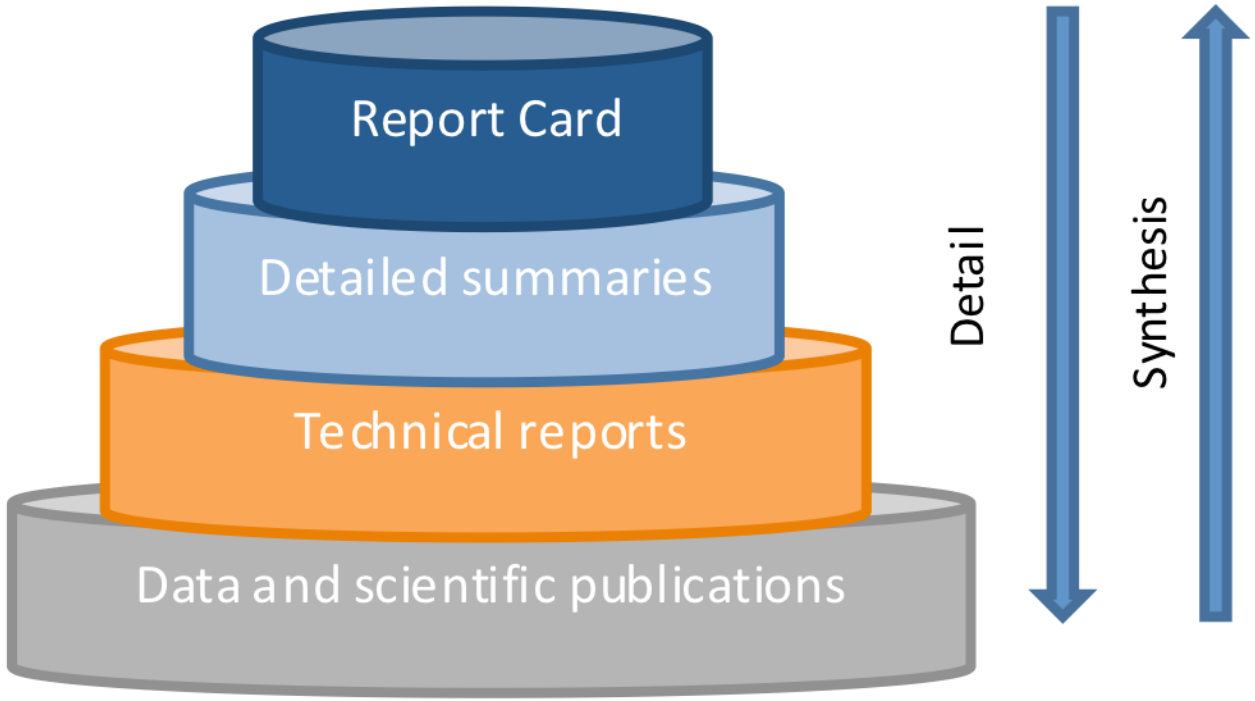
Important points…

Report cards are “showpiece” at the top of the cake – easy for public to pick up and understand key messages

Underpinned by:

- Numerous data sources,
- Contributions from a wide variety of partners

Layered so users can “drill down” into detail on attributes , e.g., tuna, kākahi, access etc

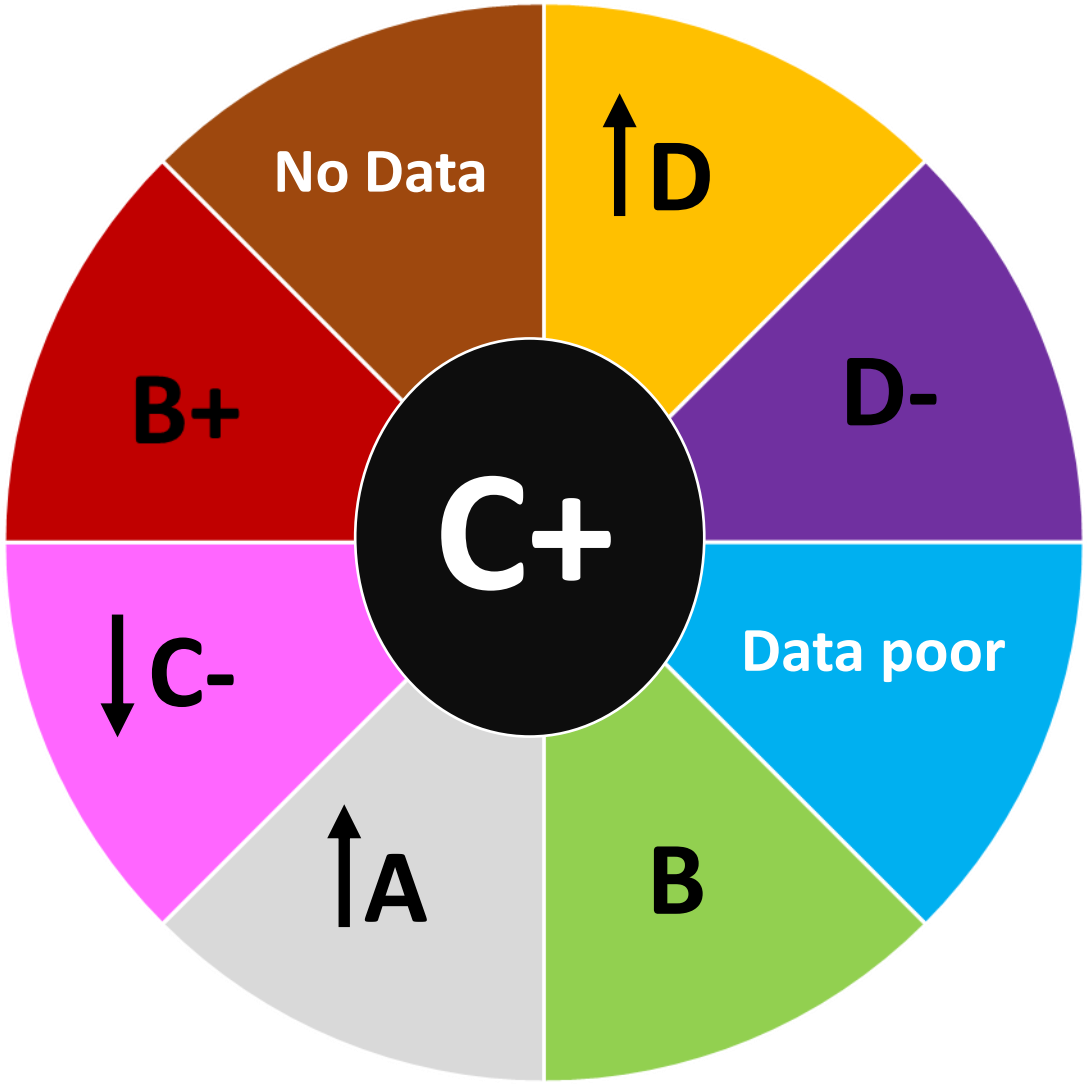


Waikato River Report Card

Currently under development – WRA funded
- includes cultural, social, economic values

Team: NIWA; Waikato Raupatu River Trust; Diffuse Sources Ltd, Uni of Queensland, Waikato River iwi Roopu

Hypothetical example of how it could look



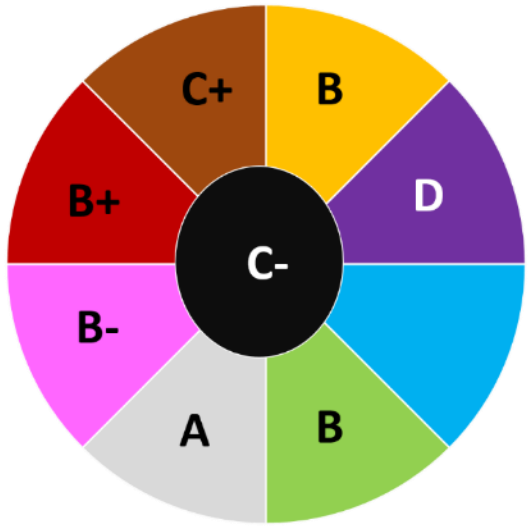
Taura	A Healthy Waikato River Catchment
Kai	Fisheries and kai (e.g., tuna, whitebait, kōura, ducks)
Water Quality	Water quality (e.g., clarity, nutrients)
Sites of Significance	Sites of significance (e.g., waahi tapu, place names, historic sites, puna)
Ecological Integrity	Ecology Biodiversity Physical character
Experience	Access Human health (e.g., contaminants) Contact recreation (e.g., *E.coli*) Rubbish Intergenerational response Information / enabling tools Education
Water Security	Water allocation / flow Efficiency and use Environmental flows, hydro ramping
Economics	Economics (e.g., GDP)
Effort	Effort in restoration (e.g., $ invested)

Page 2

Page 3

Page 4

Waikato River



- Kai
- Water Quality
- Sites of Significance
- Ecological Integrity
- Experience
- Water Security
- Economics
- Effort

Ngāruawāhia to Te Pūaha

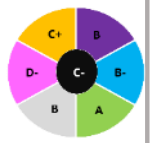
Mainstem

Tributaries

- **Narrative 1**
- **Narrative 2**

Karāpiro to Ngāruawāhia

Mainstem



Tributaries

- **Narrative 1**
- **Narrative 2**

Karāpiro to Ōhakuri

Mainstem

Tributaries

- **Narrative 1**
- **Narrative 2**

Ōhakuri to Huka Falls

Mainstem

Tributaries

- **Narrative 1**
- **Narrative 2**

Lower Waikato Lakes

Waikare

Waahi

Hakanoa

Rotopiko

- **Narrative 1**
- **Narrative 2**

Waipā

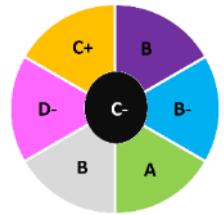
Lower Mainstem

Upper Mainstem

Tributaries

- **Narrative 1**
- **Narrative 2**
- **Narrative 3**

Taupō-nui-a-Tia



- **Narrative 1**
- **Narrative 2**

Tuakau

Huntly

Hamilton

Karāpiro

Arapuni

Tokoroa

Atiamuri

Ōhakuri

Huka Falls

Taupō

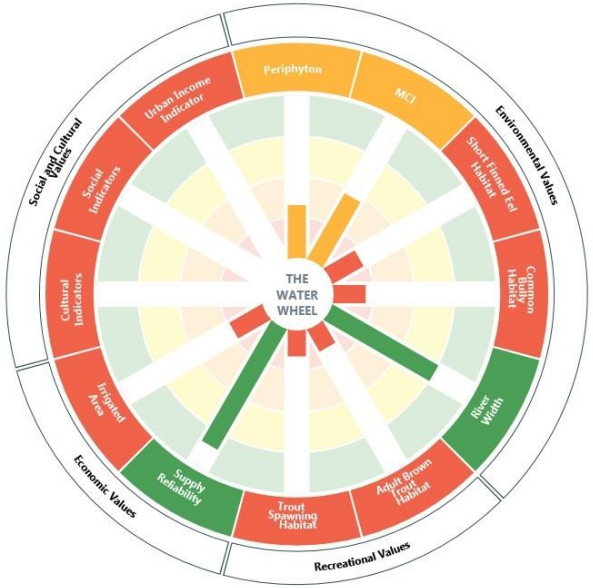
Ōtorohanga

Te Kuiti

****Hypothetical example of how it could look**

Wheel of Water

- Build on KNs or CLDs
- Synthesis of **states** of attributes across a range of value types
- Can summarise **scenario** results



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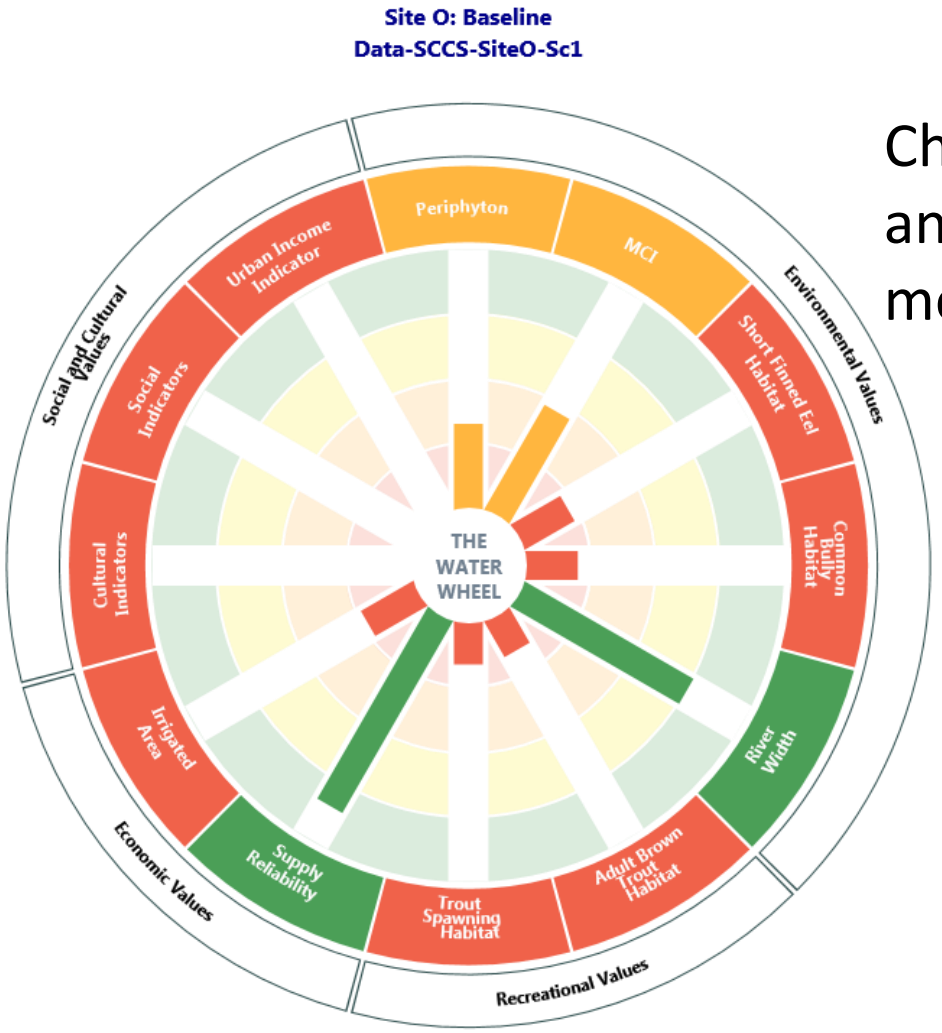
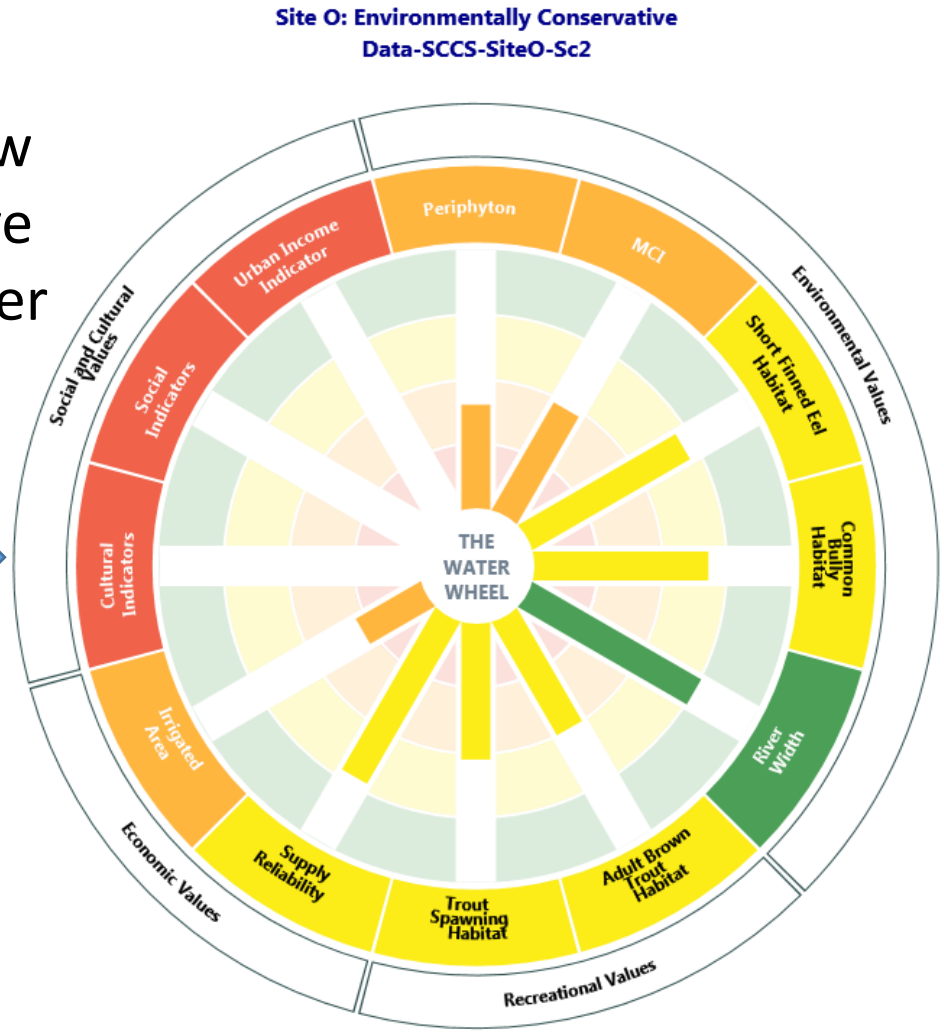
Water wheel use to illustrate scenarios – a Canterbury flow example



Change minimum flow and allocation to leave more water in the river



Baseline

Environmentally conservative

Conclusions:

- KNs and CLDs enhance collective learning
  - consensus on how the system works and reveal world views
- Manage complexity in limit setting
  - selecting values and their attributes/indicators
  - identifying
    - win:wins
    - trade-offs that may have to occur
    - areas to focus detailed predictive modelling
- Water Wheels & Report Cards summarise
  - state and trends across attributes
  - scenarios from modelling

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Discussion