Manaaki Whenua
Landcare Research

Soil Health and Resilience: oneone ora tangata ora

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Plant & Food RESEARCH
RANGAHAU AHUMĀRA KAI

agresearch
āta mātai, mātai whetū

Soil Health and Resilience: oneone ora tangata ora

Five Year MBIE Endeavour Fund Programme

Three major research aims:

I. Better define soil resilience and soil change

II. Develop Māori concepts of Soil Health

III. Develop an Integrated Soil Health Framework - Integrate different needs and aspects of Soil Health into a cohesive framework

Soil Health

The continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals and humans

Only 60 years of farming left if soil degradation continues

"Generating 3cm of top soil takes 1,000 years, and if current rates of degradation continue all of the world's top soil could be gone within 60 years", said a senior UN official.

Chris Arsenault

https://www.scientificamerican.com/article/only-60-years-of-farming-left-if-soil-degradation-continues/ (Thomson Reuters Foundation)

- Concept of Soil Health developed to counter the threat of soil degradation

Soil Health

MfE: Land report highlights issues with soil degradation (19 April 2018)

OECD Reporting National Treasury Indicators Possible NPS on Soils

UN Sustainable Development Goals

Soil Security

Capability Condition
Capital Connectivity
Codification

Soil Health

UK Farmers given first ever soil quality targets (2018)

Theme 2: Soil Performance Metrics
Theme 3: Increasing Soil Fertility + Function
Theme 4: Soil Management Solutions

SOIL HEALTH INSTITUTE

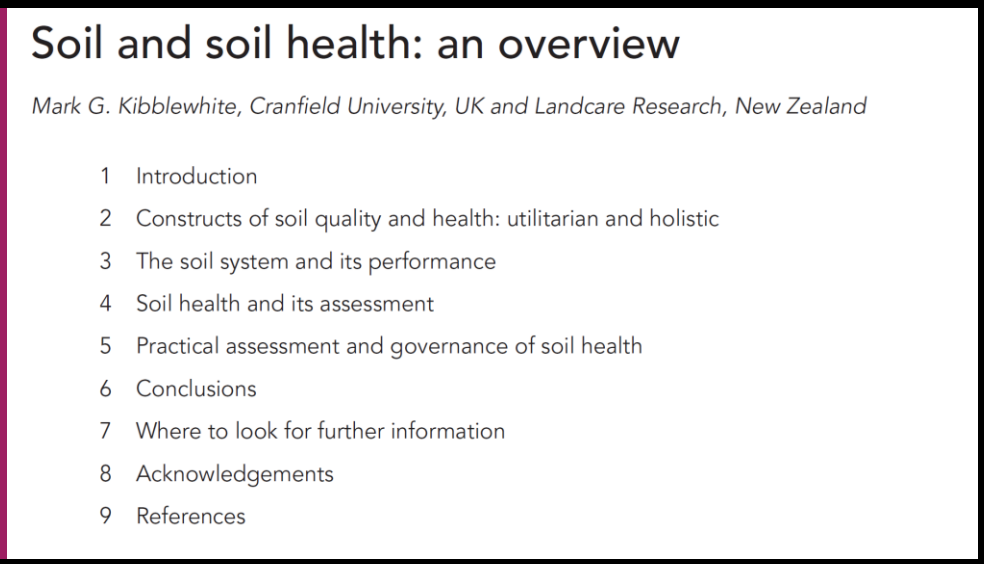
OUR MISSION:
Safeguard and enhance the vitality and productivity of soil through scientific research and advancement.

Why Are We Here?

Soil Health now being discussed in a broader context of Soil Security, Food Security and Ecosystem/Human/Global Health

- This workshop largely policy focused
- Representatives across government agencies (also industry and science representation)
- Explore underpinning concepts of soil health
- How we might broaden these concepts (particularly around Māori inclusion and social aspects)
- How do these concepts apply across different levels of government/industry and at different scales (farm, regional and national)
- How can we better integrate soil health policy across these levels to achieve the outcome of better soil health across Aotearoa/NZ?

Soil Health From a Traditional Science Perspective



- The utilitarian concept of soil quality…[was] developed when the dominant construct of soil was as a medium for plant growth….
- Following the Millennium Ecosystem Assessment (2005) and the introduction of the concept of natural capital…**a holistic construct of soil health has emerged, as an integrative measure of the condition of a multifunctional living system…**

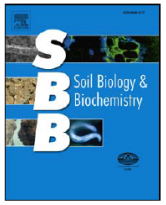
Utilitarian vs Ecosystem (Ecological) vs Ecosystem Services views

Several Recent Reviews…

Contents lists available at ScienceDirect

Soil Biology and Biochemistry

journal homepage: www.elsevier.com/locate/soilbio



Review Paper

Soil quality – A critical review

Else K. Bünemann[a,*], Giulia Bongiorno[a,b], Zhanguo Bai[c], Rachel E. Creamer[b], Gerlinde De Deyn[b], Ron de Goede[b], Luuk Fleskens[d], Violette Geissen[d], Thom W. Kuyper[b], Paul Mäder[a], Mirjam Pulleman[b,e], Wijnand Sukkel[f], Jan Willem van Groenigen[b], Lijbert Brussaard[b]

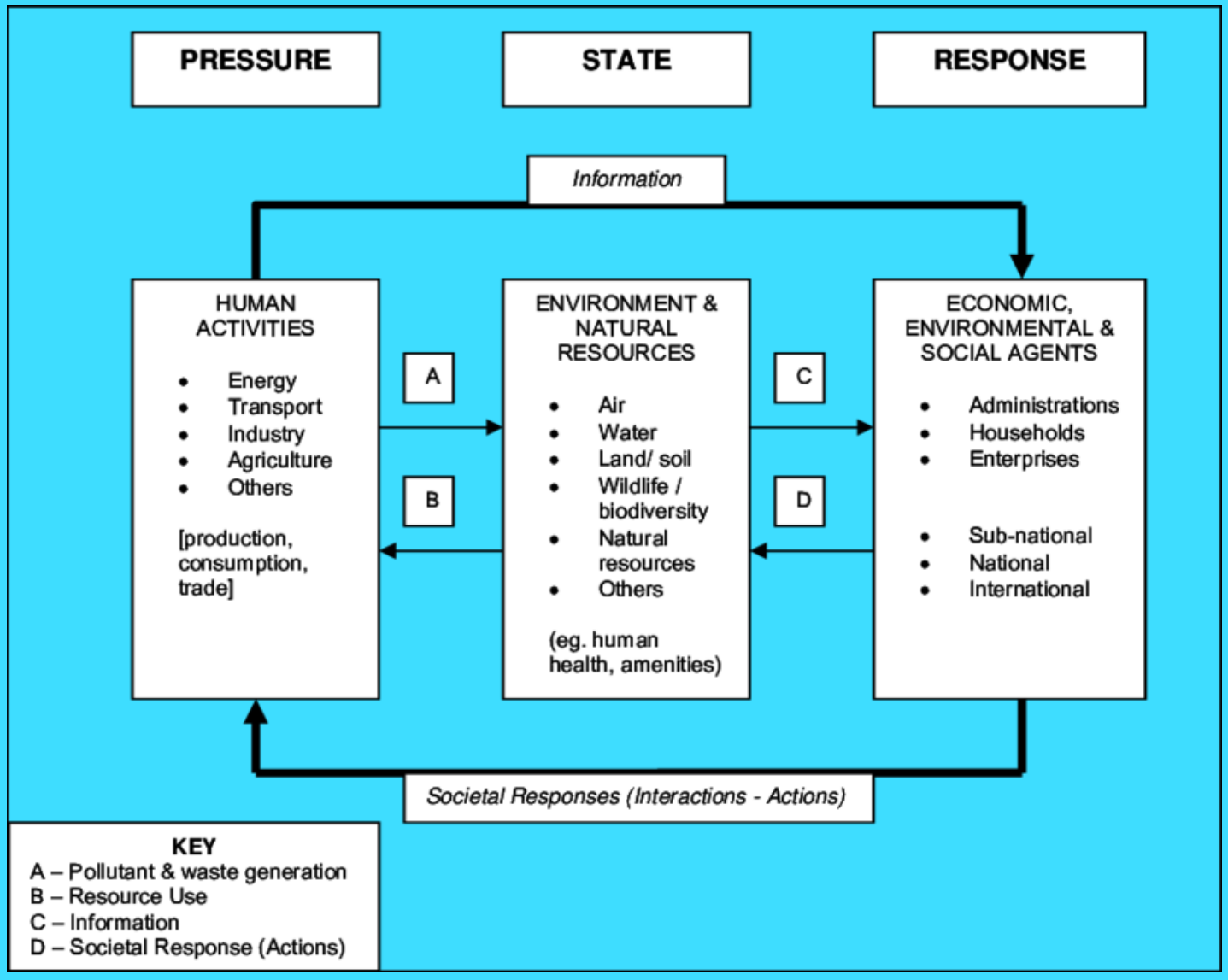
- Explicit evaluation of soil quality (including specific soil threats, soil functions and ecosystem services) has rarely been implemented

- Few approaches provide clear interpretation schemes of measured indicator values. This limits their adoption by land managers as well as policy.

Current State of Environment Reporting in NZ

How are we currently measuring Soil Health?

Underpinning Development - Pressure / State / Response Model

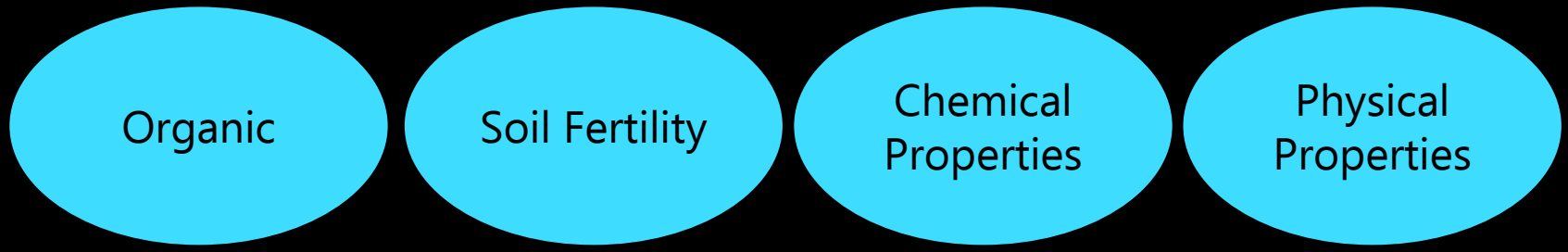


Source: OECD 2003

Current Soil Health SOE reporting in NZ

developed from the 500 Soils Programme

- Minimum dataset approach (7 main indicators)
- Development of Target Ranges
  - balanced production and environmental concerns
- Reporting by exception (meets or does not meet target ranges)



Organic	Soil Fertility	Chemical Properties	Physical Properties
Total carbon **Total nitrogen** **Mineralisable N** [HW carbon]	**Olsen P** (available phosphorous)	**pH** [Contaminants/ Trace Elements]	**Bulk density** **Macroposity**

Soil Health Institute (2017) – Tier 1 indicators

- **Organic carbon**
- **pH**
- Water-stable aggregation
- Crop yield
- Texture
- Penetration resistance
- Cation exchange capacity
- Electrical conductivity
- **Nitrogen**
- **Phosphorus**
- Potassium

- Carbon mineralization
- **Nitrogen mineralization**
- Erosion rating
- Base saturation
- **Bulk density**
- Available water holding capacity
- Infiltration rate
- Micronutrients

- **Macroporosity**
- Contaminants

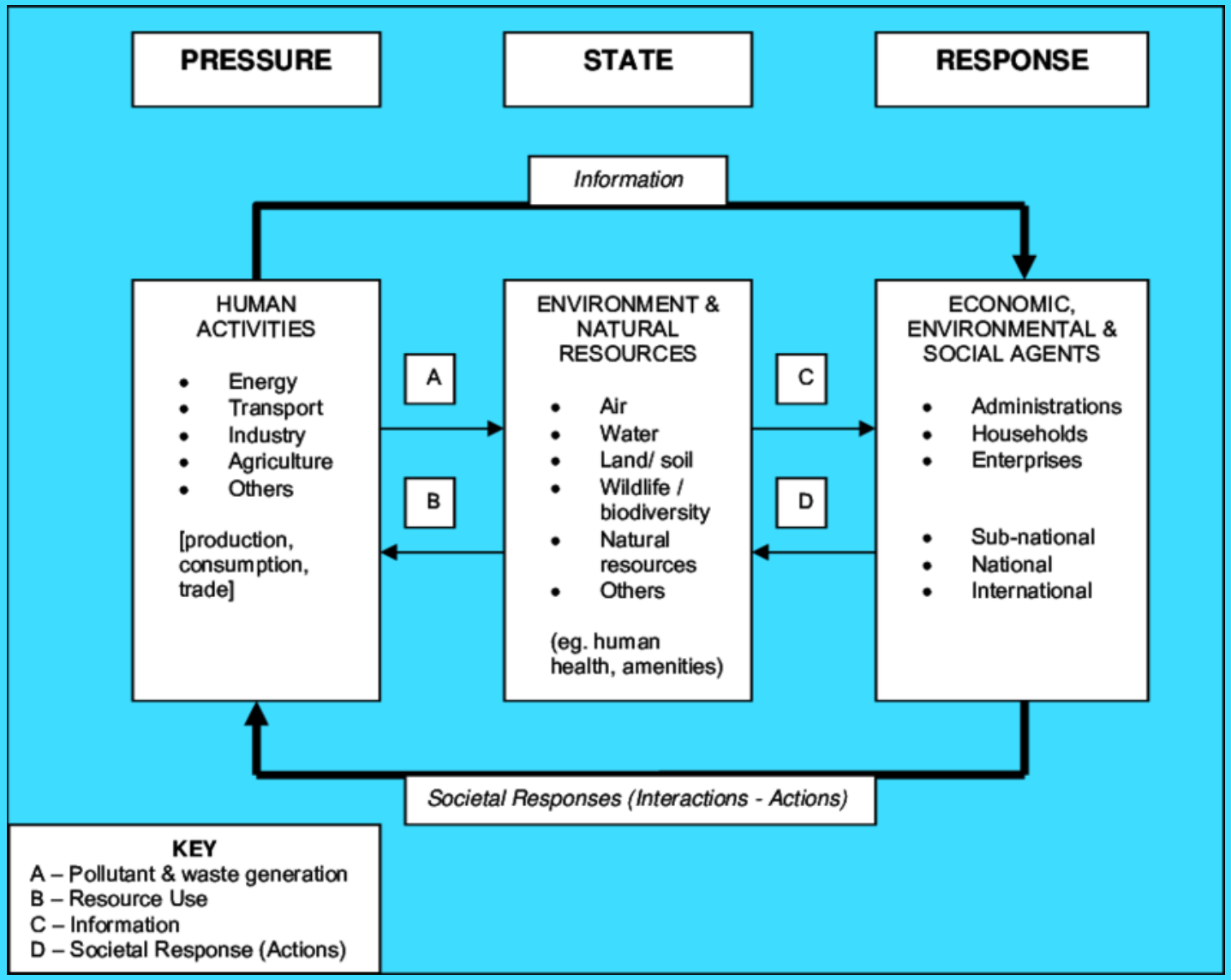
+ Hot-water Carbon

[http://soilhealthinstitute.org/tier-1-indicators-soil-health/]

Expanding the concept of Soil Health into a larger framework of ecosystem/human/global health

- Garth - Māori aspects of soil health
- *Dean – expanding the conceptual model of how we view soil health*

Revisiting PSR Model – Do different levels of government (and sectors) view this differently?



Source: OECD 2003