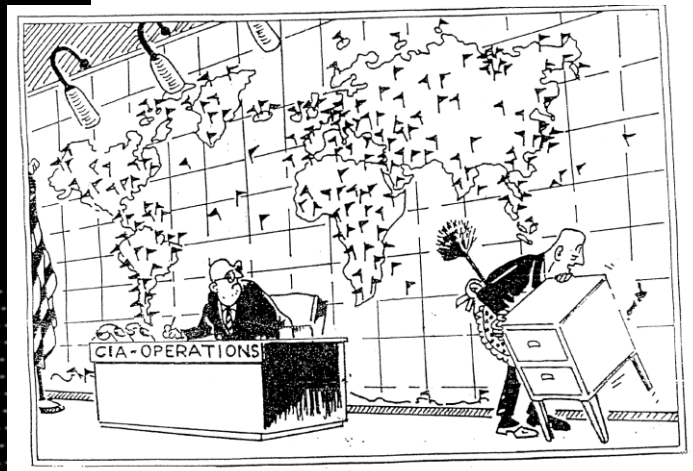
Towards a preliminary assessment of the soil security dimensions in Aotearoa/New Zealand

Pierre Roudier, **Linda Lilburne**, Anne-Gaelle Ausseil, Gerard Grealish, Bryan Stevenson, Sam Carrick, Andrew Manderson, Suzie Greenhalgh, Garth Harmsworth, Elektra Kalaugher

Manaaki Whenua
Landcare Research



"Hey, Chuck"

Why are we interested?

NZ economy is dependent on a diverse and highly productive primary sector

Not all soils are resilient

Only 24% of NZ multi-use potential

Some soils are erodible and leaky

Outline – the C's

- Capability
- Condition
- Capital
- Connectivity
- Codification

- Challenges

Geoderma 213 (2014) 203–213

Contents lists available at ScienceDirect

Geoderma

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

ELSEVIER

GEODERMA

The dimensions of soil security ☆

CrossMark

Alex McBratney [a], Damien J. Field [a,*], Andrea Koch [b]

Capability – what functions can soil perform?

- NZ very active in soil mapping 50’s through to 80’s
- Demise – 80’s due to focus on inventory (stamp collecting) and taxonomy without linking to purpose and losing touch with NZ base
- Rebirth – purpose to support specific regional needs (e.g. Southland topoclimate); then national drivers
- Strong knowledge of soil chemistry (fertiliser driven), current focus is on soil physics, weaker on soil biology

Capability – what functions can soil perform?

- LRI – FSL 16 soil property classes – national scale
- S-map 34% NZ; 63% of multiple use land
  - Hybrid traditional and DSM
  - various pedo-transfer functions (soil physics)
- Developing some national scale DSM raster products (soil chemistry attributes)

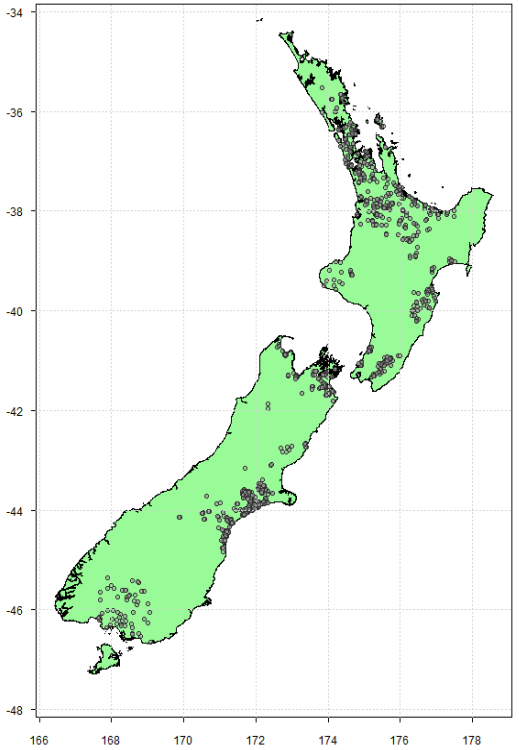
Condition – how healthy are our soils?

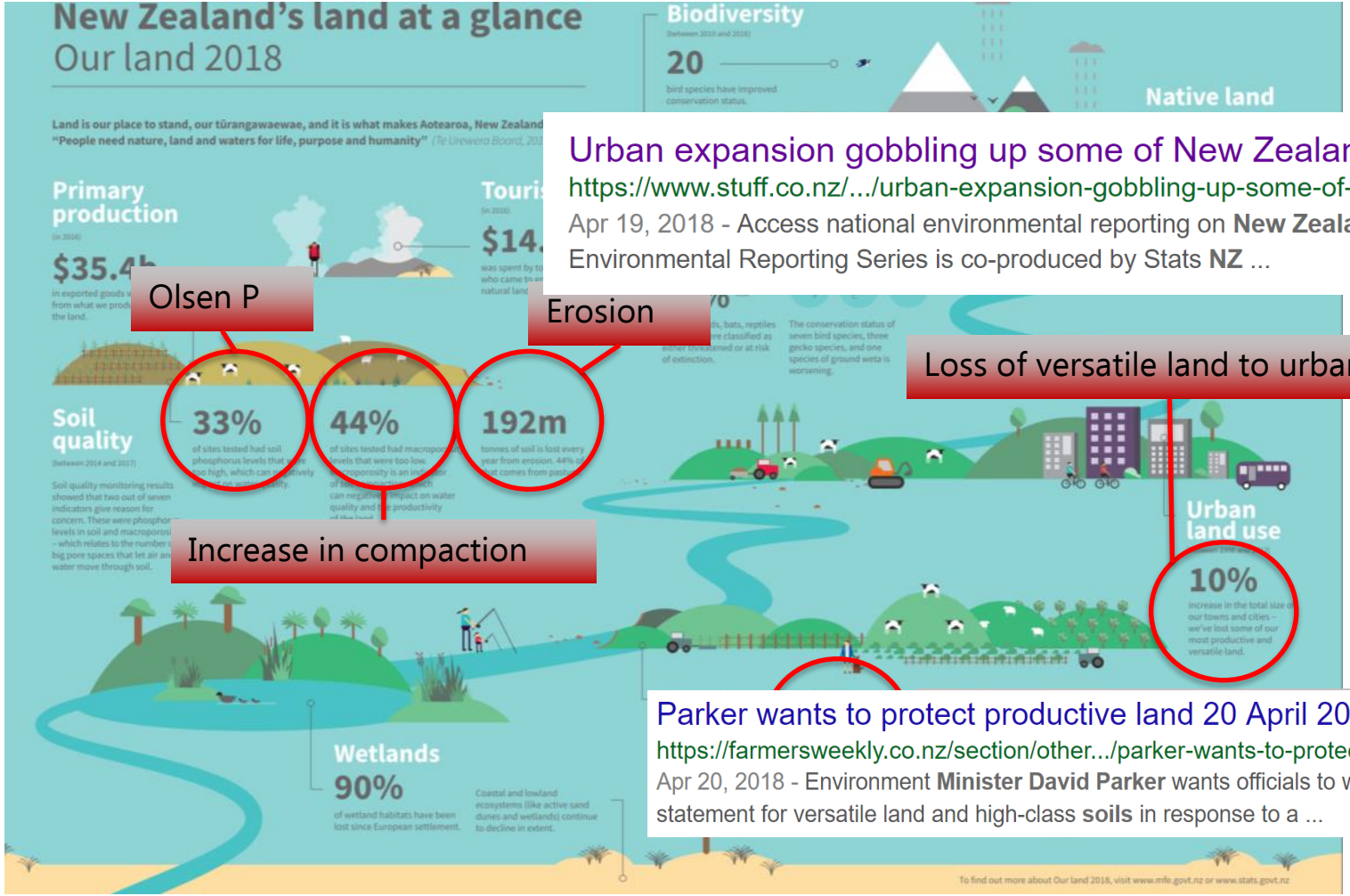
Monitoring

Regional/national SoE reporting

- Currently ~1000 sites, 0-10cm, sites resampled 2-4 times (but numbers vary by region)

- 7 indicators (minimum data set)
  - Organic (total C and N, mineralisable N)
  - Physical (bulk density, macroporosity)
  - Chemical (pH) – trace elements added later
  - Fertility (Olsen P)





Urban expansion gobbling up some of New Zealand's most versatile ...
https://www.stuff.co.nz/.../urban-expansion-gobbling-up-some-of-new-zealands-most-ve...
Apr 19, 2018 - Access national environmental reporting on **New Zealand's land**. **New Zealand's** Environmental Reporting Series is co-produced by Stats **NZ** ...

Parker wants to protect productive land 20 April 2018 - Farmers Weekly
https://farmersweekly.co.nz/section/other.../parker-wants-to-protect-productive-land
Apr 20, 2018 - Environment **Minister David Parker** wants officials to work on a national policy statement for versatile land and high-class **soils** in response to a ...

Capital – what value do our soils have?

Geoderma 241–242 (2015) 107–114

Contents lists available at ScienceDirect

Geoderma

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

Soil natural capital quantification by the stock adequacy method

Allan Hewitt [a,*], Estelle Dominati [b], Trevor Webb [a], Tom Cuthill [a]

Ecosystem Services 27 (2017) 1–14

Contents lists available at ScienceDirect

Ecosystem Services

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

Using ecosystem services to underpin cost–benefit analysis: Is it a way to protect finite soil resources?

S. Greenhalgh [a,*], O. Samarasinghe [a], F. Curran-Cournane [b], W. Wright [a], P. Brown [c]

Soil stock adequacy – intensive dairy

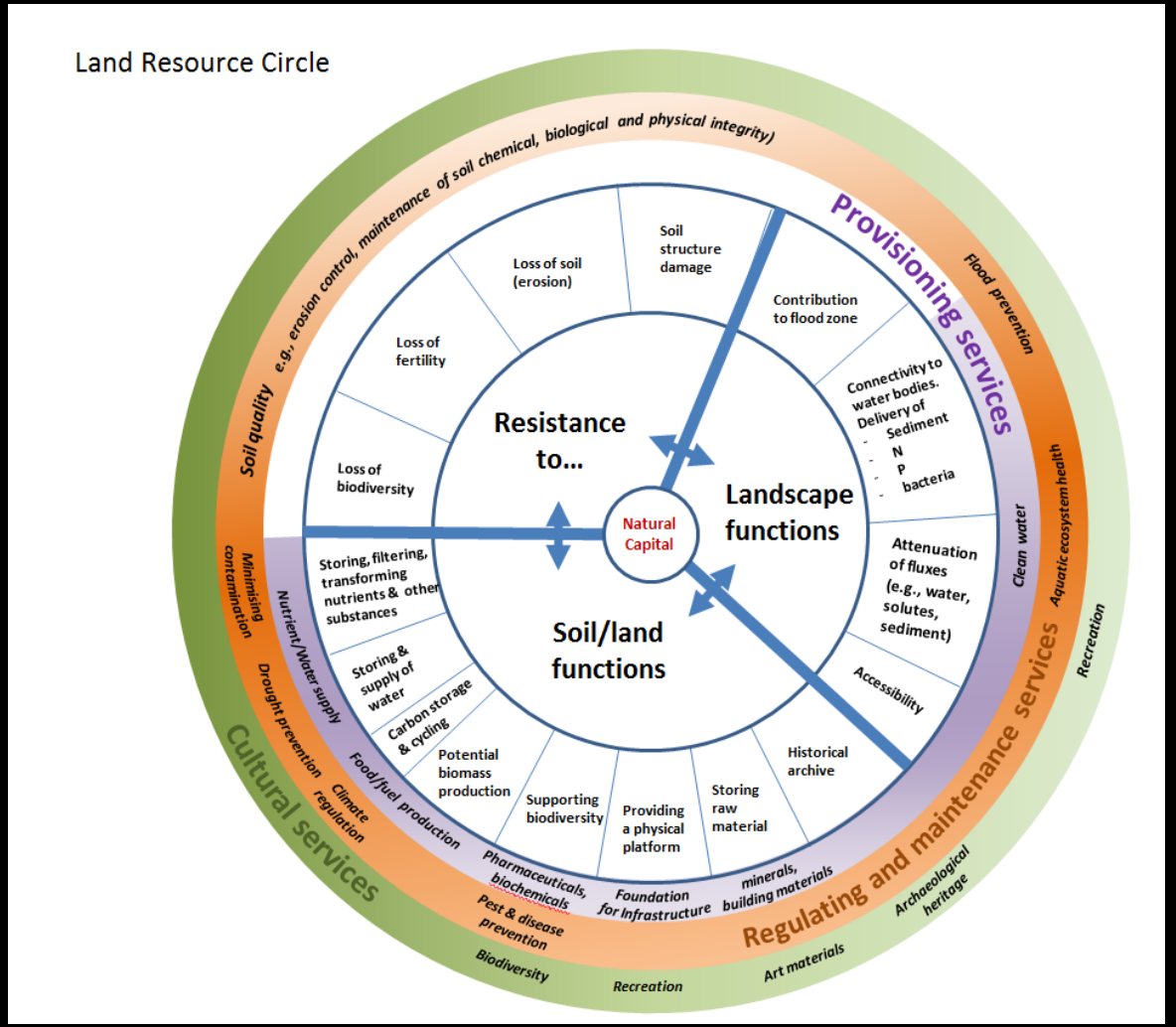
	Flaxton	Waimakariri	Barrhill	Eyre	Rangitata
Pasture quantity	98	94	76	48	20
N filtering	100	100	88	19	6
Denitrification	70	0	0	0	0
P filtering	42	16	16	7	3
Microbial filtering	30	90	50	50	30
Water storage	100	68	51	16	3
SNC (Av%)	73	61	47	23	10

What Method to summarise results for a soil?

- Cost-benefit of soil info to spatially target N leaching mitigation (CBR of 1:6)
- Farm scale valuation of soil ES

Capital

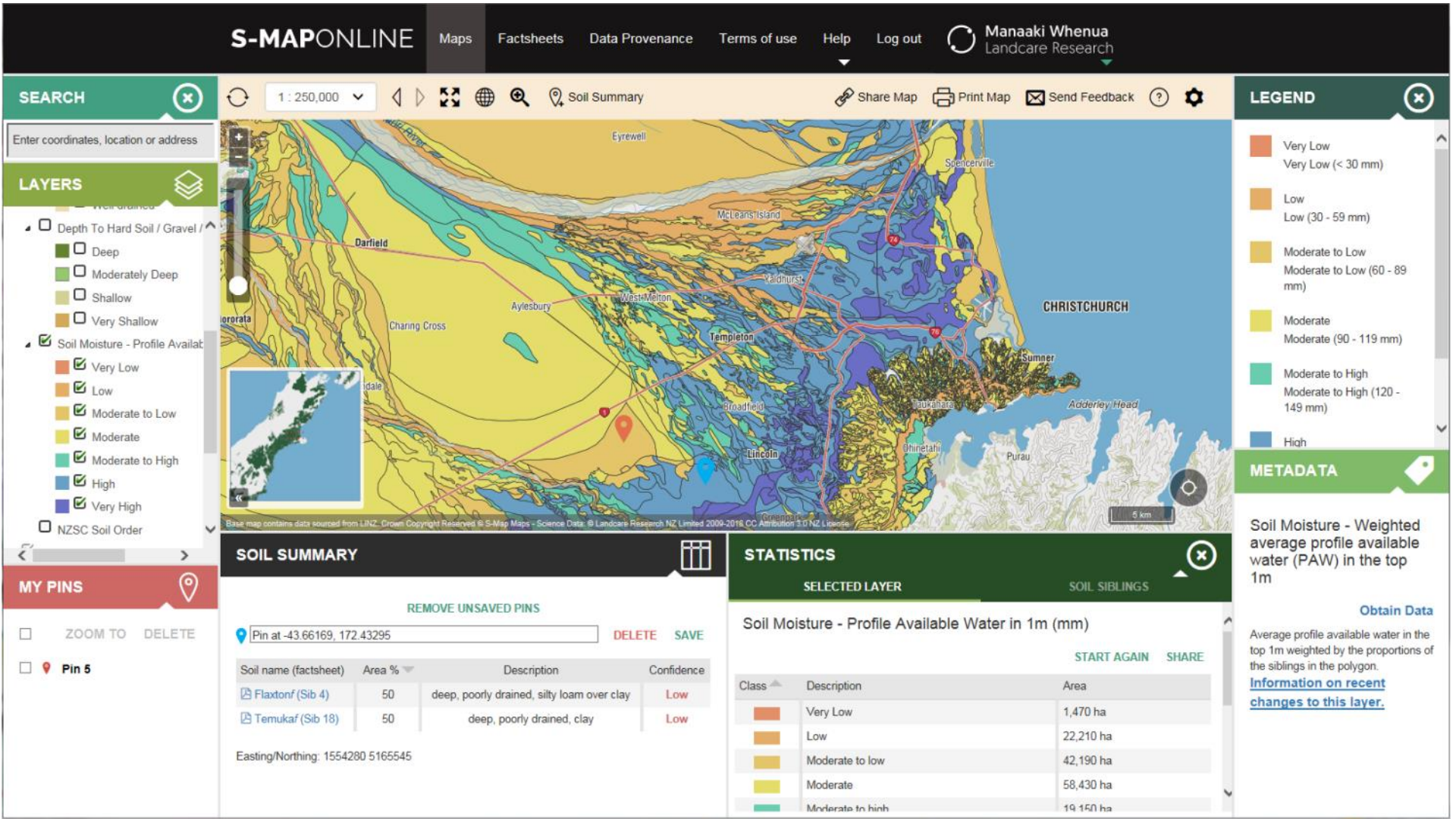
- Soil ecosystem services
  - CEC (2006) functions
  - Resistance functions
  - Landscape functions



Connectivity – how well is society connected to soil?

- Communication – difficult, soil science not 'sexy' headline grabbing for communication and engagement. But have the advantage of being so dependent on the primary sector.
- Education– decline/dilution of soil science training (university departments, due to low student numbers to support ongoing specific course training)
- Science extension is not well funded
- Loss of knowledge
  - that is in books (intergenerational loss of knowledge)
  - Soil attribute mapping vs taxonomy (soil story)
- Te Ao Māori - very strongly connected to the land traditionally (cultural identity, customary use, traditional knowledge) and economically (land ownership)

> *"To the early Māori, land was everything. Bound up with it was survival, politics, myth, and religion. It was not part of life, but life itself".*
> Asher G; Naulls D, 1987: Maori Land. New Zealand Planning Council, Wellington.


S-MAPONLINE
Maps
Factsheets
Data Provenance
Terms of use
Help
Log out
Manaaki Whenua
Landcare Research
SEARCH
Enter coordinates, location or address
LAYERS
Depth To Hard Soil / Gravel /
Deep
Moderately Deep
Shallow
Very Shallow
Soil Moisture - Profile Availab
Very Low
Low
Moderate to Low
Moderate
Moderate to High
High
Very High
NZSC Soil Order
MY PINS
ZOOM TO
DELETE
Pin 5
1 : 250,000
Soil Summary
Share Map
Print Map
Send Feedback
Eyrewell
Spencerville
McLeans Island
Darfield
Kaiapoi
Aylesbury
West Melton
CHRISTCHURCH
Charing Cross
Templeton
Sumner
Broadfield
Tukahata
Adderley Head
Lincoln
Ohinetahi
Purau
Greenpark
5 km
Base map contains data sourced from LINZ. Crown Copyright Reserved © S-Map Maps - Science Data: © Landcare Research NZ Limited 2009-2016 CC Attribution 3.0 NZ License
LEGEND
Very Low
Very Low (< 30 mm)
Low
Low (30 - 59 mm)
Moderate to Low
Moderate to Low (60 - 89 mm)
Moderate
Moderate (90 - 119 mm)
Moderate to High
Moderate to High (120 - 149 mm)
High
METADATA
Soil Moisture - Weighted average profile available water (PAW) in the top 1m
Obtain Data
Average profile available water in the top 1m weighted by the proportions of the siblings in the polygon.
Information on recent changes to this layer.
SOIL SUMMARY
REMOVE UNSAVED PINS
Pin at -43.66169, 172.43295
DELETE
SAVE
Soil name (factsheet)
Area %
Description
Confidence
Flaxtonf (Sib 4)
50
deep, poorly drained, silty loam over clay
Low
Temukaf (Sib 18)
50
deep, poorly drained, clay
Low
Easting/Northing: 1554280 5165545
STATISTICS
SELECTED LAYER
SOIL SIBLINGS
Soil Moisture - Profile Available Water in 1m (mm)
START AGAIN
SHARE
Class
Description
Area
Very Low
1,470 ha
Low
22,210 ha
Moderate to low
42,190 ha
Moderate
58,430 ha
Moderate to high
19,150 ha

Codification – what regulations guide/control use of soil?

- NZ policy/direction (implemented at regional level)
  - Resource Management Act;
  - Environment Reporting Act;
  - National Policy Statement for Freshwater Management (nutrients, sediment);
  - National Environmental Standard for plantation forestry (erosion);
  - Kyoto protocol (soil carbon)
  - NPS for versatile land??

  Note:
    - Soil not specifically protected
    - No controls over land use (effects-based controls)
- Industry-led Best Management Practices (some are soil focussed)
- Dept of Conservation (30% of NZ)

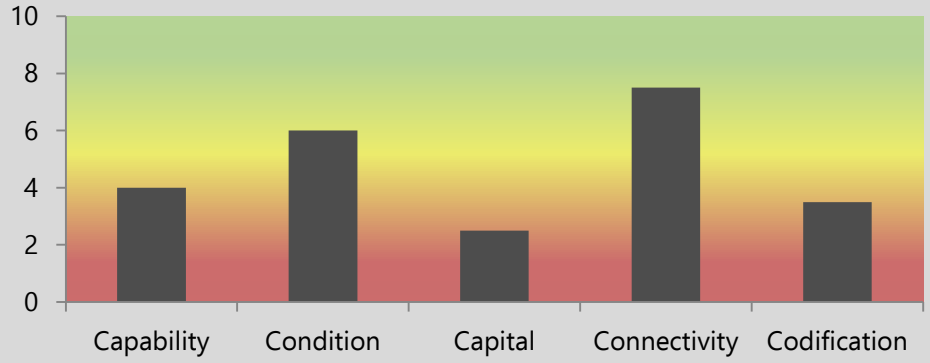
Our Challenges

Capability & Condition

- Moving to a more stable funding regime – seeing soil information (intrinsic and dynamic) as key national infrastructure (need 100% coverage)

Capital

- Quantifying & combining soil ES services



Connectivity

- Intergenerational knowledge transfer
  - Paper to digital
  - University training capability

Codification

- Versatile soils: how to define it?
- Ensure a focus on soil (not diluted under other issues) & recognition that some land should not be farmed