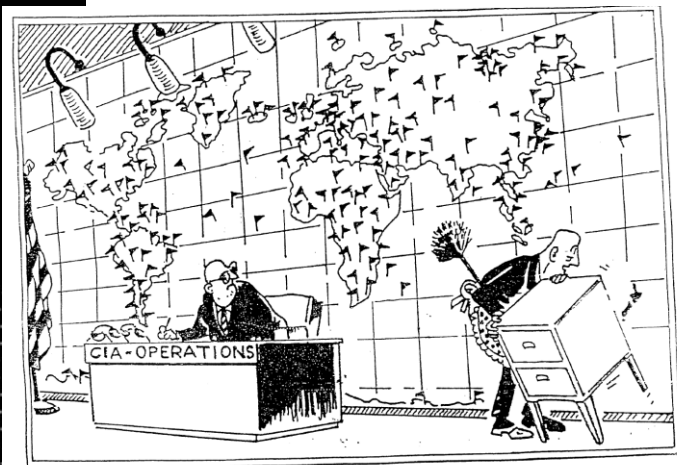


Towards a preliminary assessment of the soil security dimensions in Aotearoa/New Zealand

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

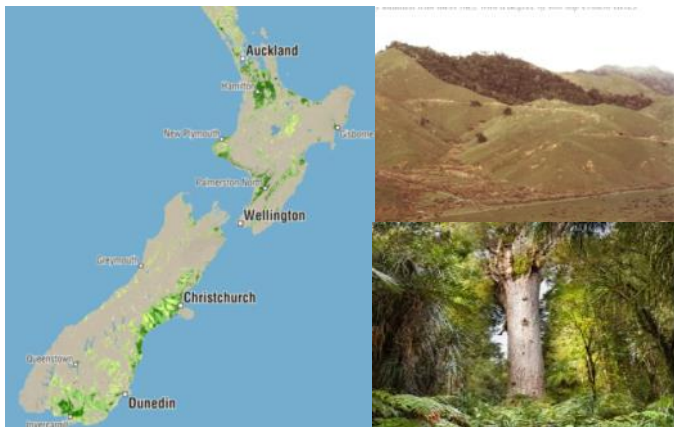


“Hey, Chuck”

Why are we interested?



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



Only 24% of NZ multi-use potential



Not all soils are resilient



Some soils are erodible and leaky



Outline – the C's

- Capability
- Condition
- Capital
- Connectivity
- Codification
- Challenges



The dimensions of soil security[☆]

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)

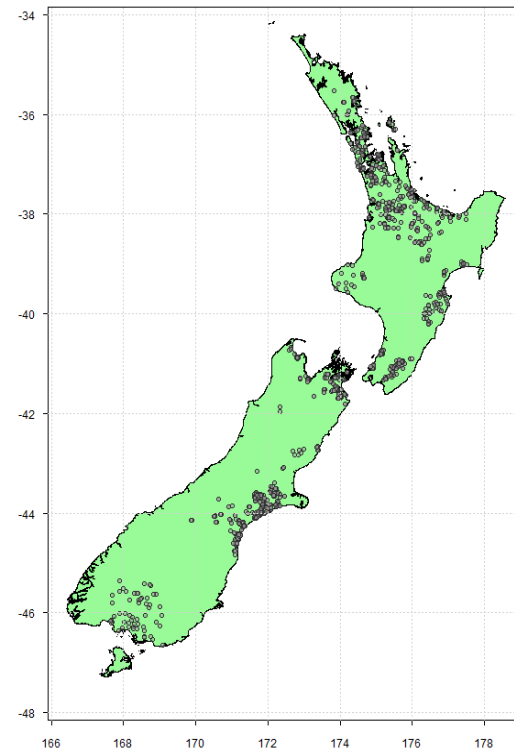


Condition – how healthy are our soils?

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)





New Zealand's land at a glance

Our land 2018

Land is our place to stand, our tūrangawaewae, and it is what makes Aotearoa, New Zealand
"People need nature, land and waters for life, purpose and humanity" (Te Urewera Board, 2017)

Primary production

(in 2016)

\$35.4b

in exported goods
from what we produce
on the land.

Tourism

(in 2016)

\$14.1b

was spent by
tourists who came to
enjoy our natural land.

Soil quality

(between 2014 and 2017)

Soil quality monitoring results
showed that two out of seven
indicators give reason for
concern. These were phosphorus
levels in soil and macroinvertebrates
- which relates to the number of
big pore spaces that let air and
water move through soil.

33%

of sites tested had soil
phosphorus levels that were
too high, which can negatively
impact on soil productivity.

44%

of sites tested had macroinvertebrate
levels that were too low. This
responsibility is an indicator
of soil health, which can negatively
impact on water quality and soil
productivity.

192m

tonnes of soil is lost every
year from erosion. 44% of
that comes from pasture.

Increase in compaction

Wetlands

90%

of wetland habitats have been
lost since European settlement.

Coastal and lowland
ecosystems (like active sand
dunes and wetlands) continue to
decline in extent.

Biodiversity

(between 2012 and 2016)

20

bird species have improved
conservation status.

Native land

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 ...

Erosion

Loss of versatile land to urban

Urban land use

10%

increase in the total size of
our towns and cities -
we've lost some of our
most productive and
versatile land.

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

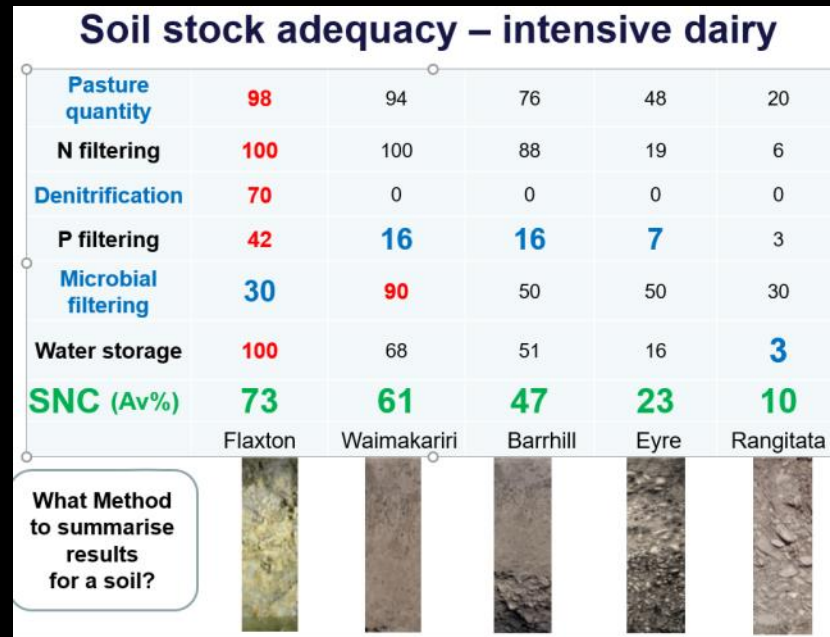
Geoderma

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?

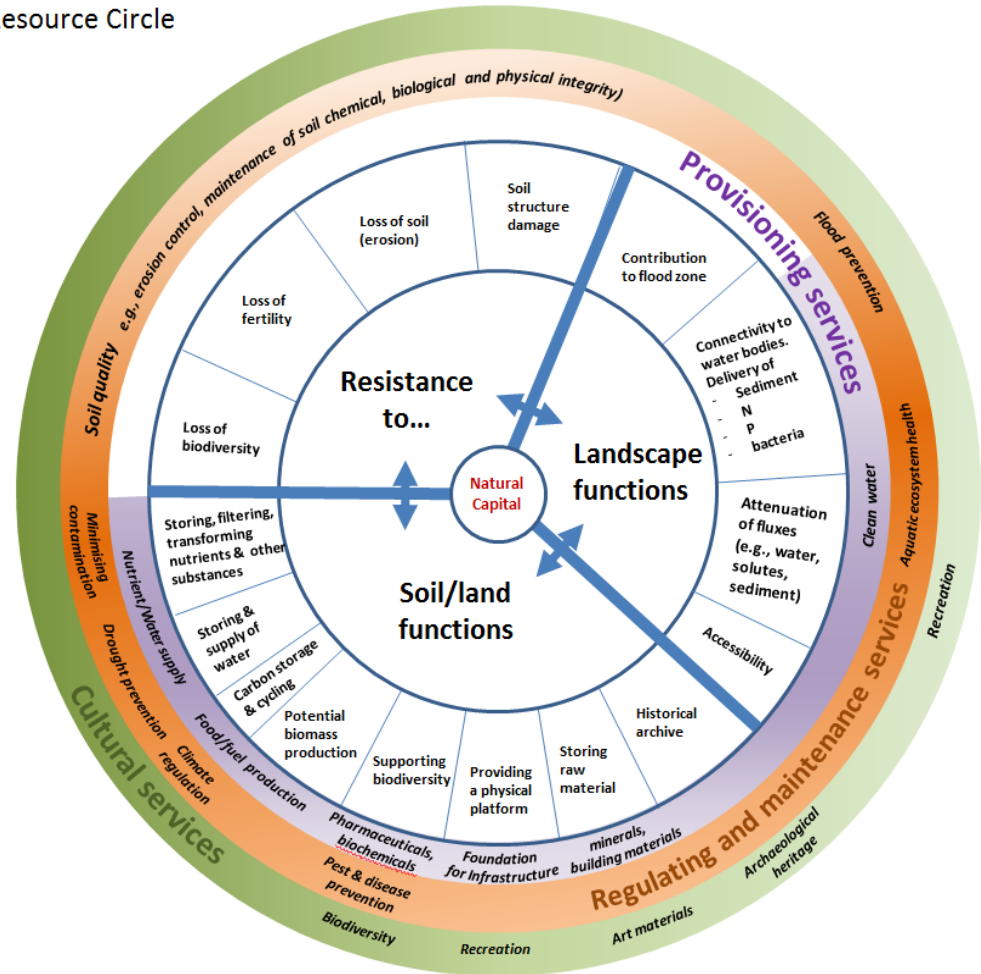
S. Greenhalgh^{a,*}, O. Samarasinghe^a, F. Curran-Cournane^b, W. Wright^a, P. Brown^c

- 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

Land Resource Circle





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.



SEARCH

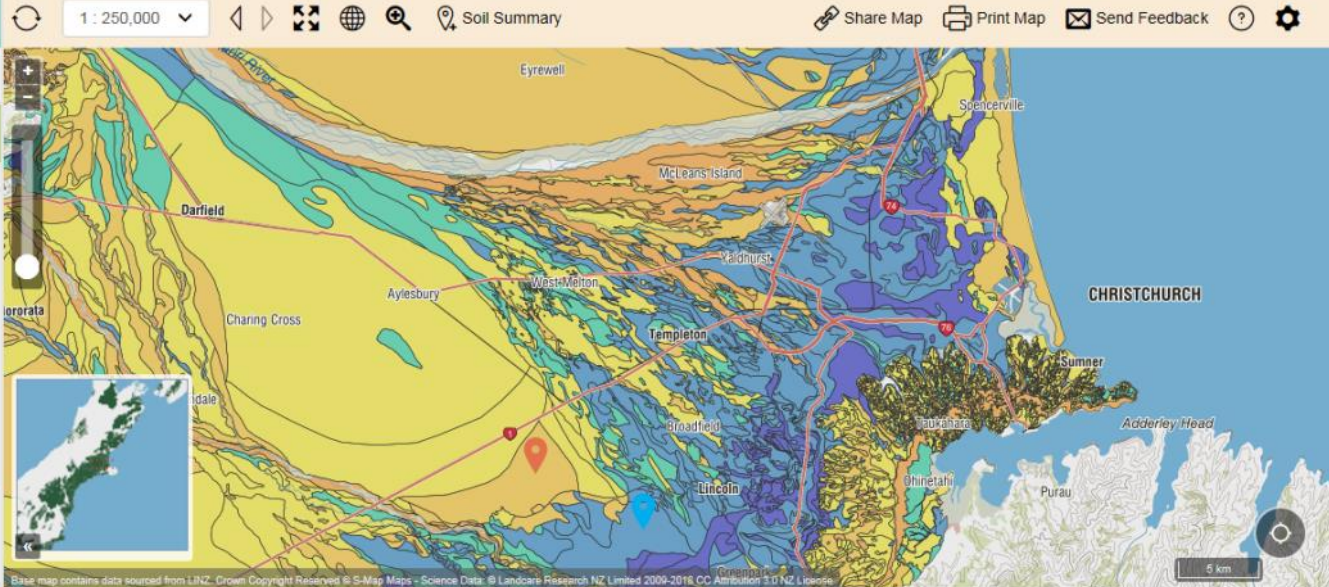


Enter coordinates, location or address

LAYERS



- ☐ Well drained
- ☐ Depth To Hard Soil / Gravel /
- ☐ Deep
 - ☐ Moderately Deep
 - ☐ Shallow
 - ☐ Very Shallow
- ☒ Soil Moisture - Profile Available
- ☒ Very Low
 - ☒ Low
 - ☒ Moderate to Low
 - ☒ Moderate
 - ☒ Moderate to High
 - ☒ High
 - ☒ Very High
- ☐ NZSC Soil Order



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

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.](#)



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)



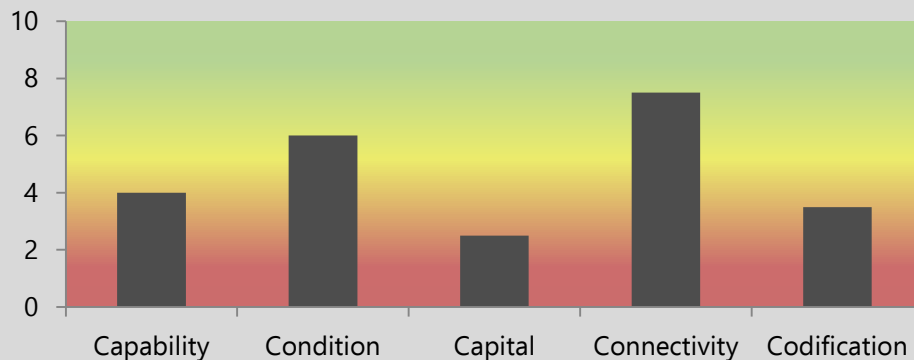
Our Challenges

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