

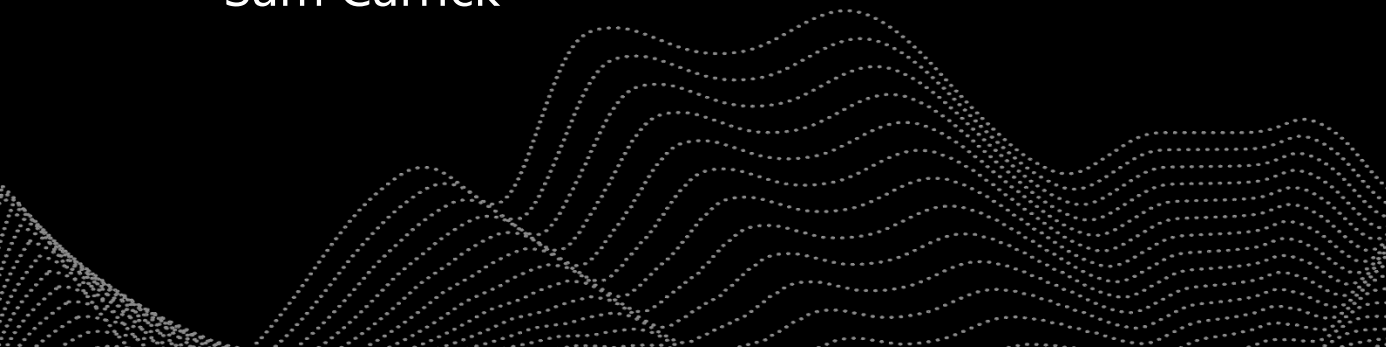


Manaaki Whenua
Landcare Research

The Secret's in the Soil

Linda Lilburne

Sam Carrick



What words describe S-map'?





Outline – 3 parts & 4 questions

- S-map 101
- S-map inference engine
- Coverage and funding

Part I: New Zealand is a land of high pedo-diversity



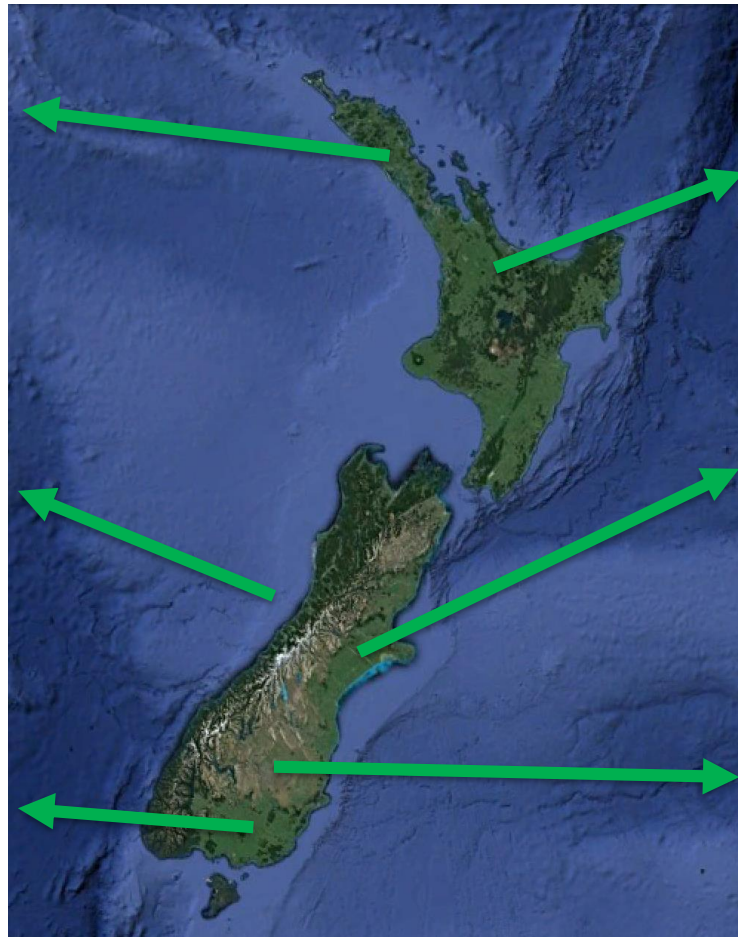
Old clays



Rainforest
Podzols



Loess
downlands



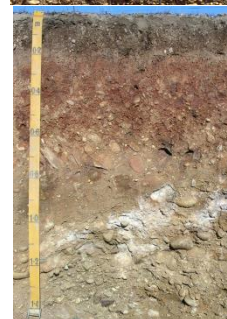
Volcanic
Tephra



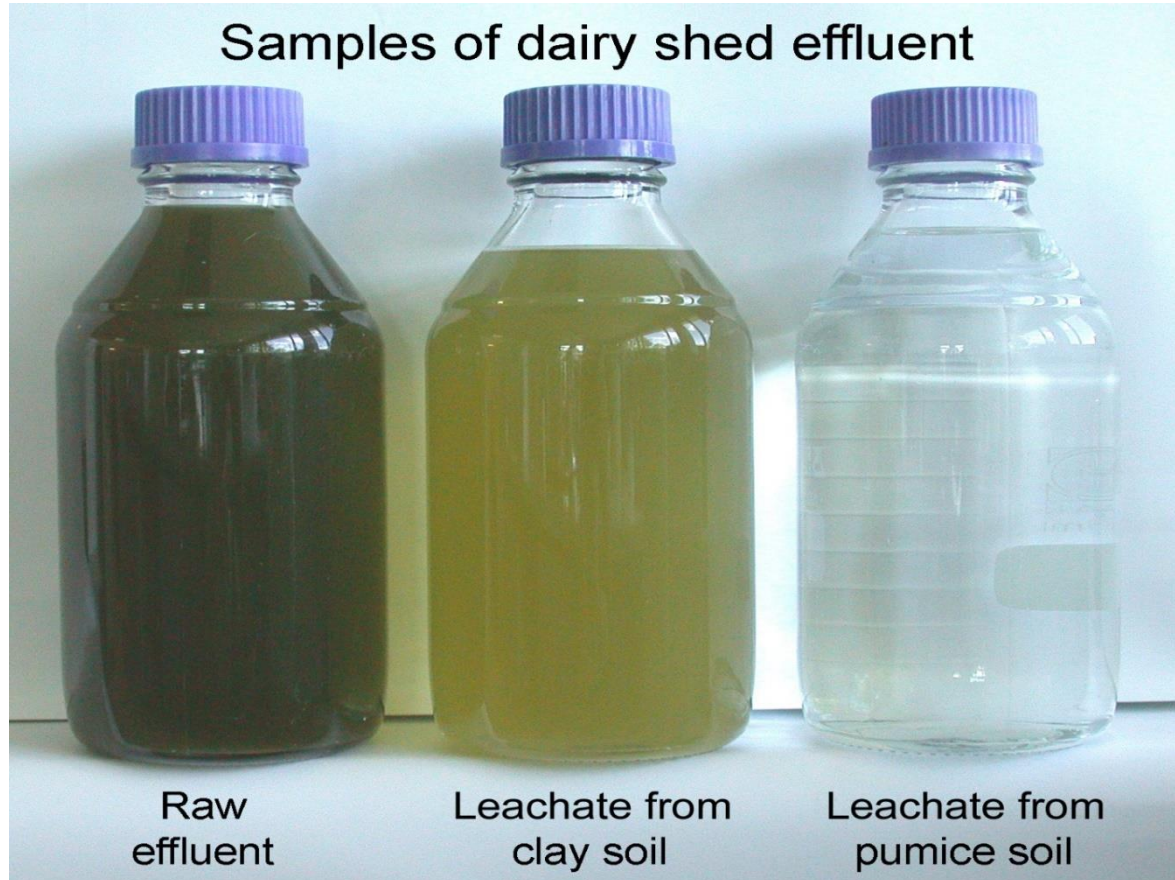
Glacial
outwash



Semi-arid

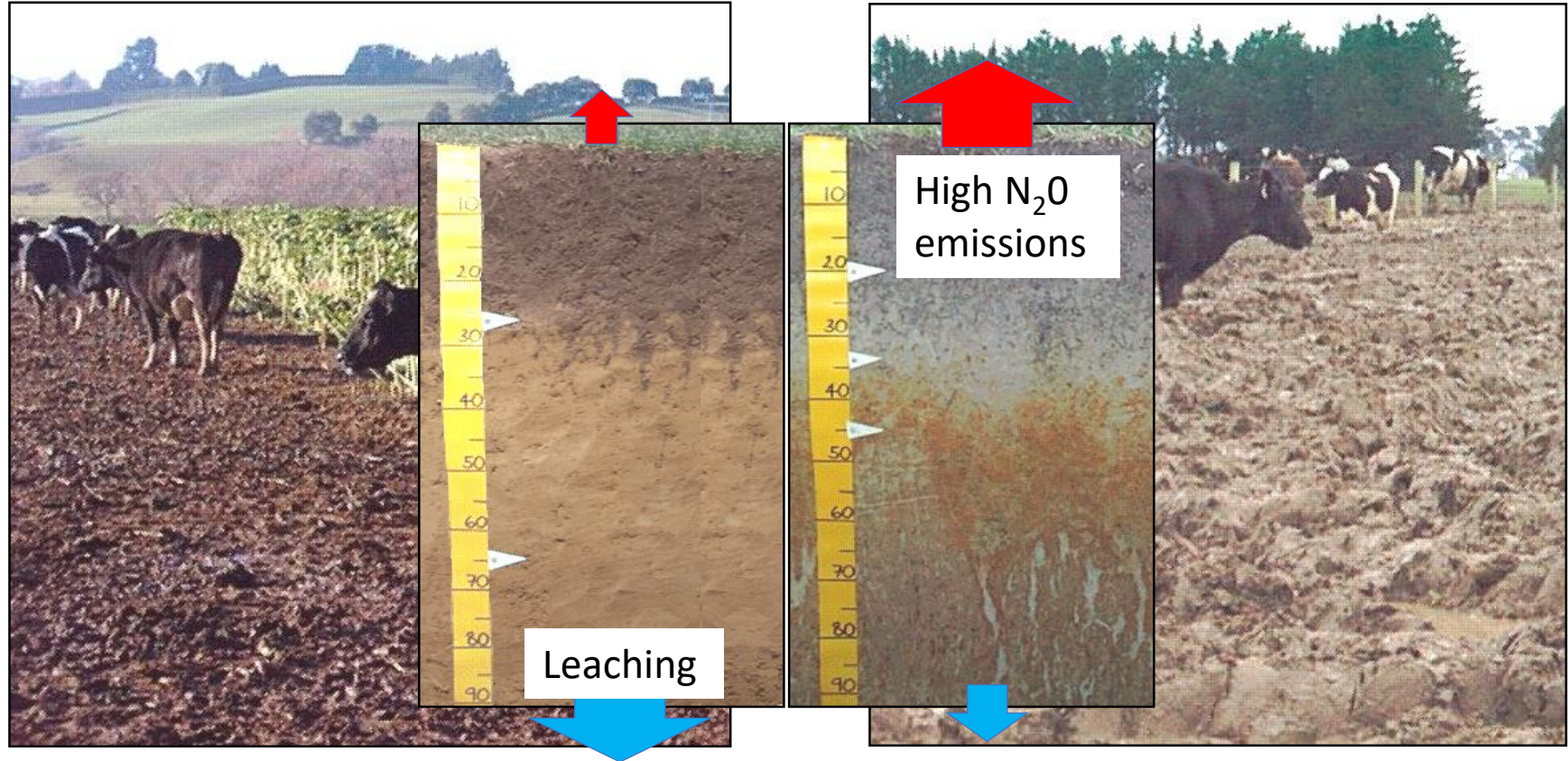


Soils vary in filtering capacity





Soils respond differently to pressure



S-map

Prime Goals

- Comprehensive soil map for NZ
- Common and consistent standard
- Built upon the best available mapping/modelling techniques
- Quantitative information for every soil
- Adaptable to changing requirements
- Support decision-making at all scales: nation to farm
- Easy to access





Other related datasets

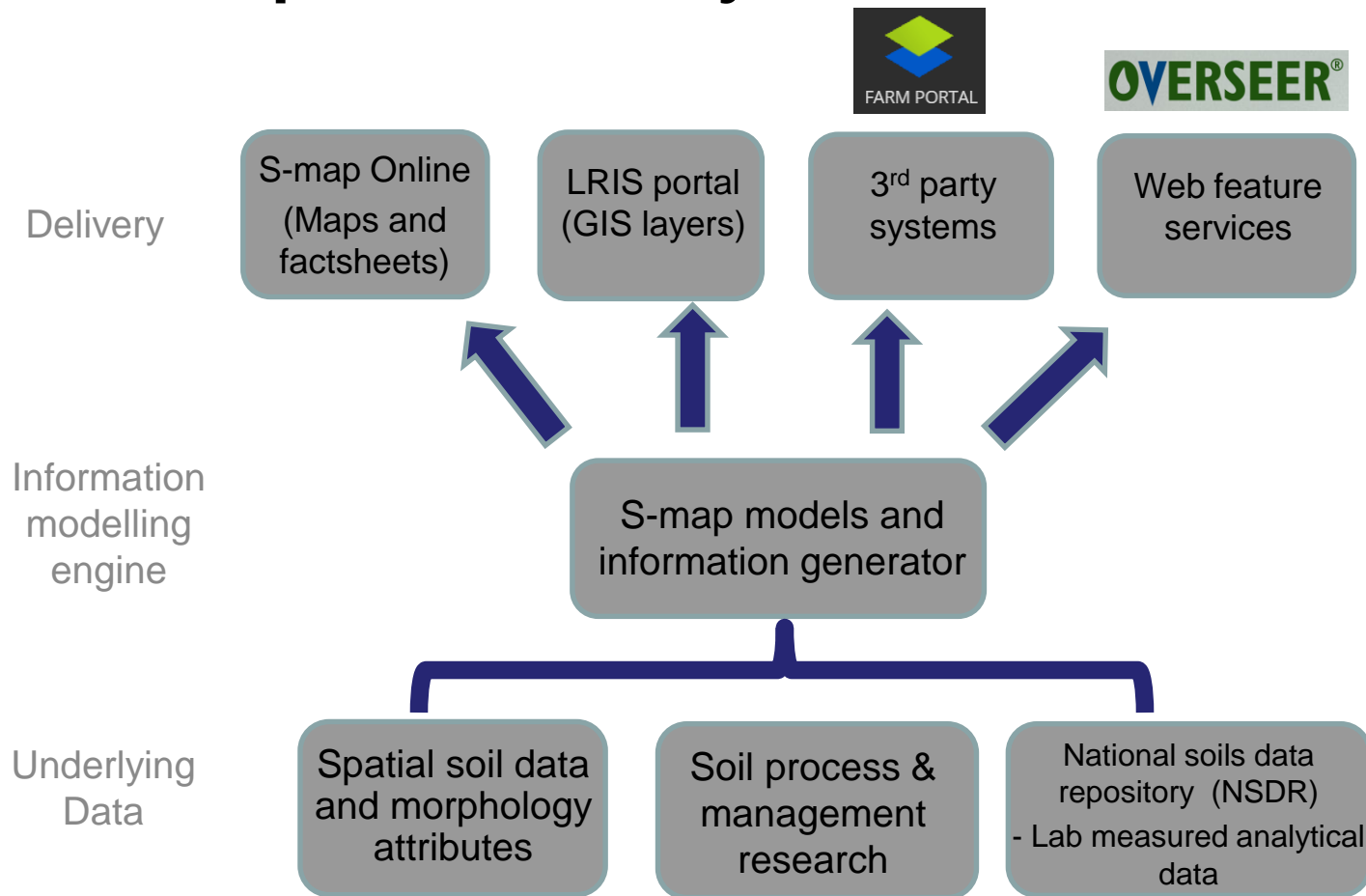
NSDR – the National Soil Data Repository of individual point observations (often with measured analytical data)

S-map – maps the spatial pattern of soil variability across the landscape

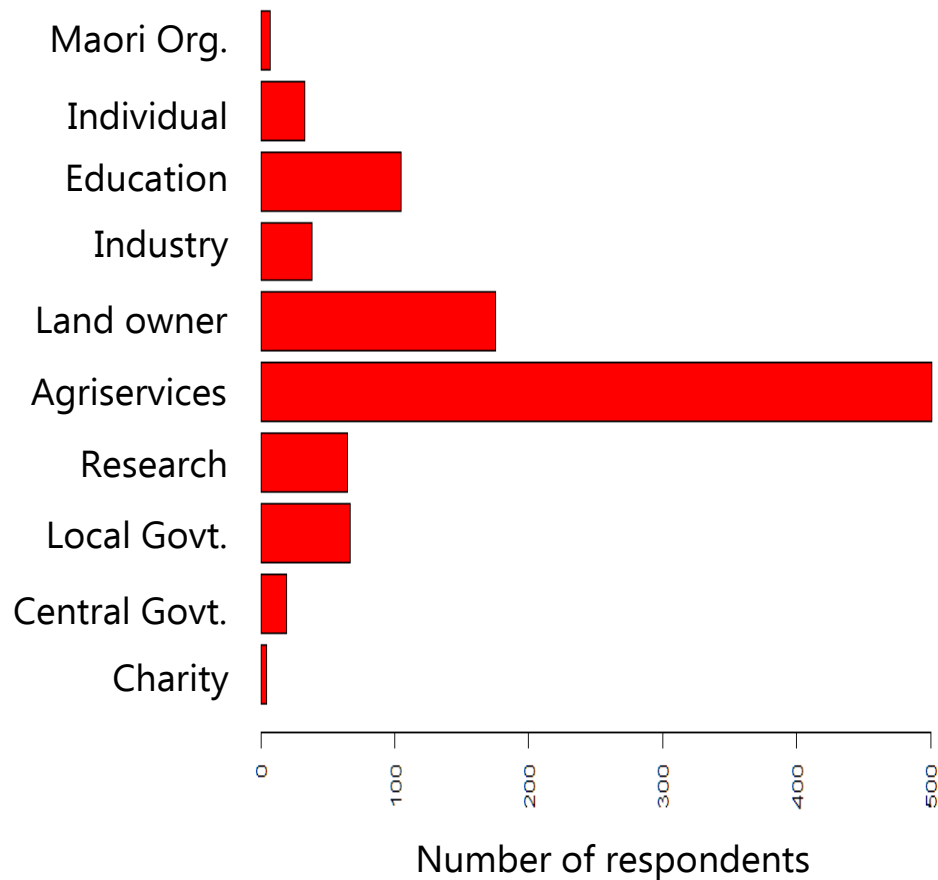
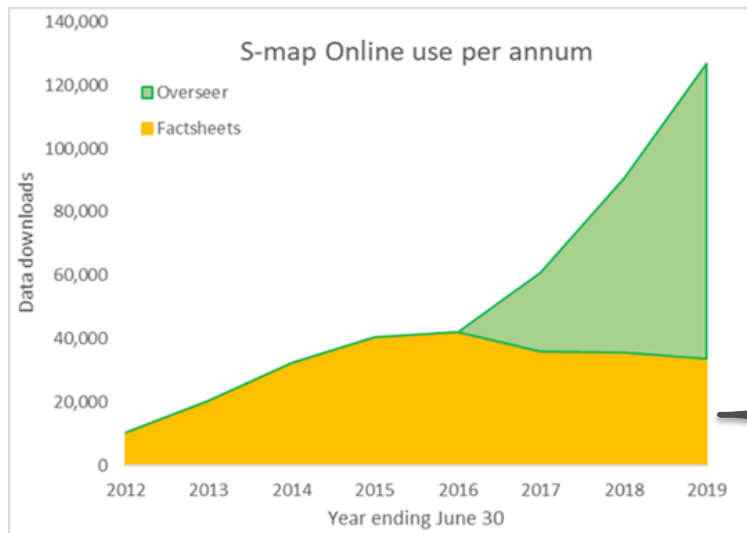
LRI – national scale inventory of 5 land attributes (Slope, Soil, Vegetation, Parent rock, Erosion)

LUC – combines soil information with three other land attributes (climate, slope, parent material) to classify the overall capability of the land and erodibility.

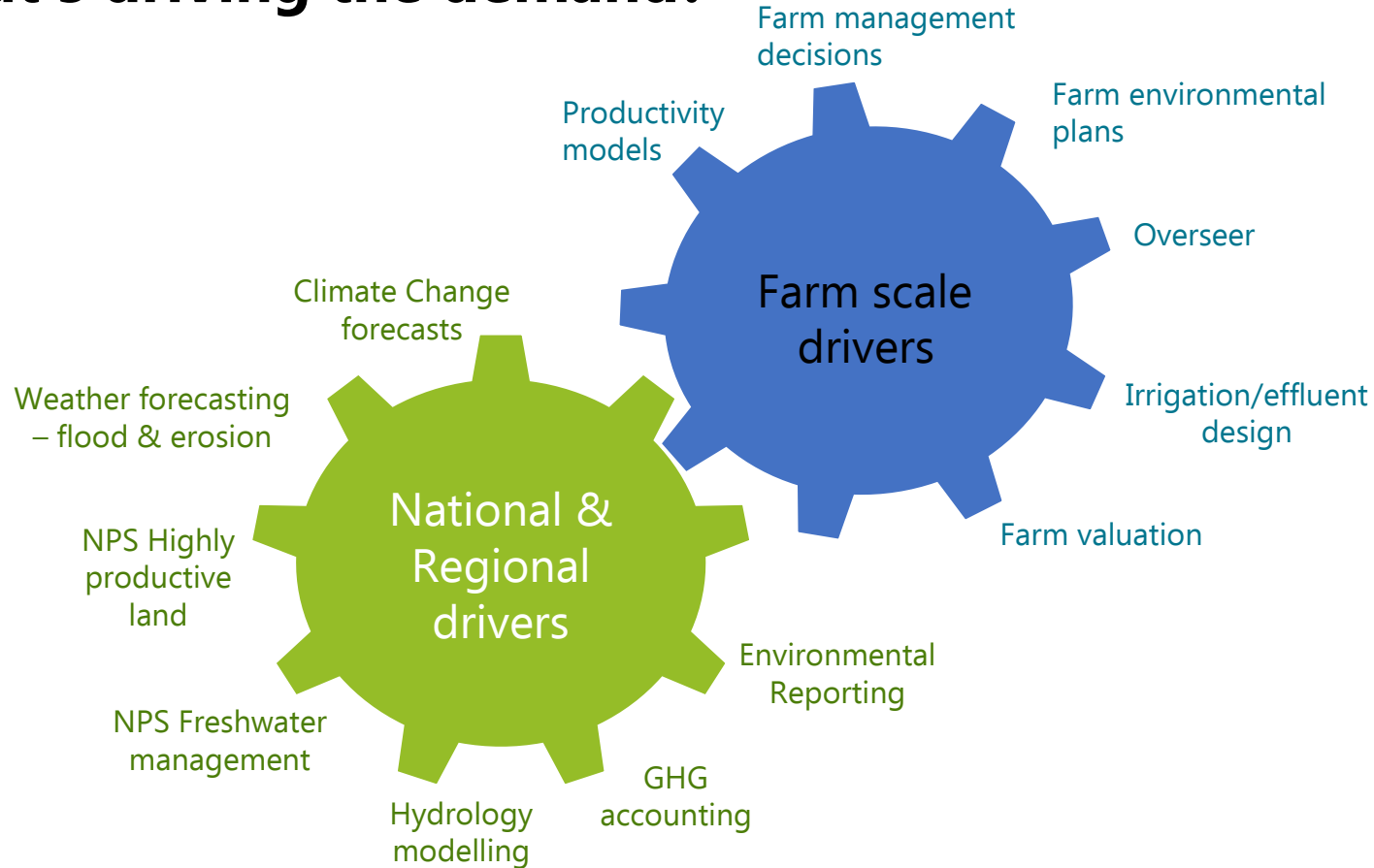
S-map information system



Who uses it?

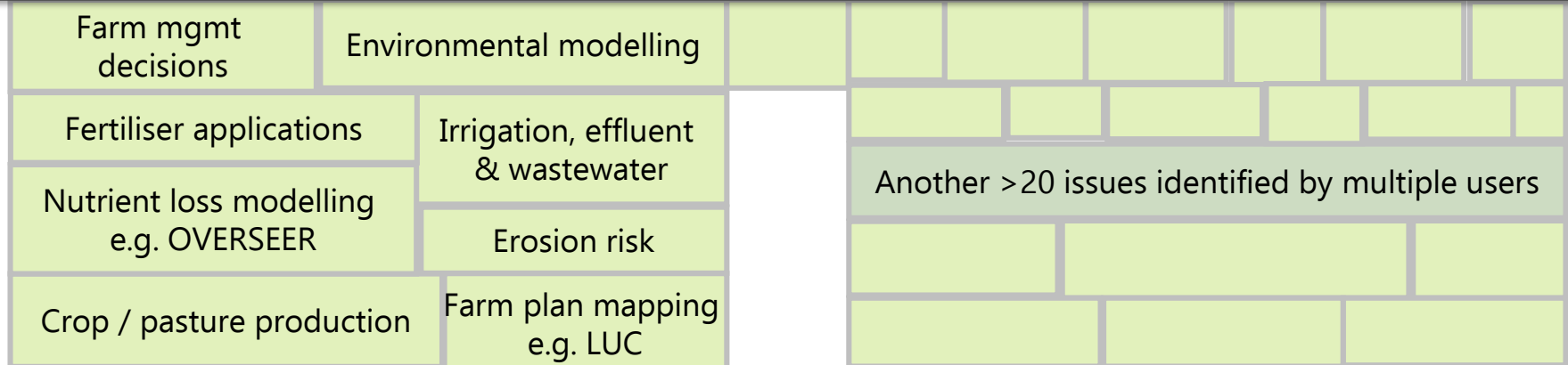


What's driving the demand?





NZ environmental and socio-economic wellbeing



S-map information is a foundation for planning, decision-making and investment across a wide range of issues



Part I: key take home message

Soil information is important for a wide range of issues and where available it is extensively used.

Interactive Question 2:

Which one of these soils has the greatest versatility for highly productive land?



Soil A



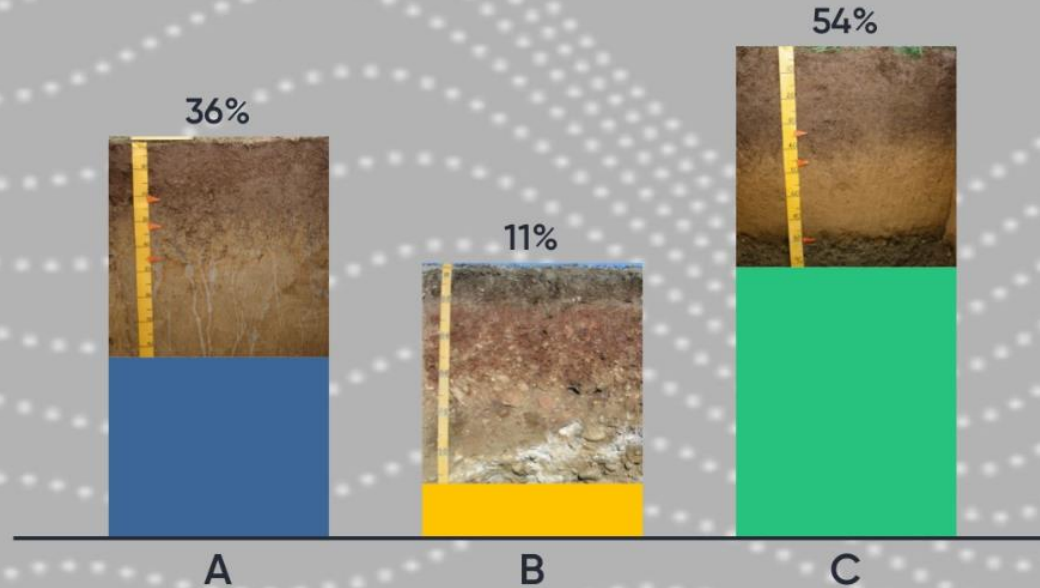
Soil B



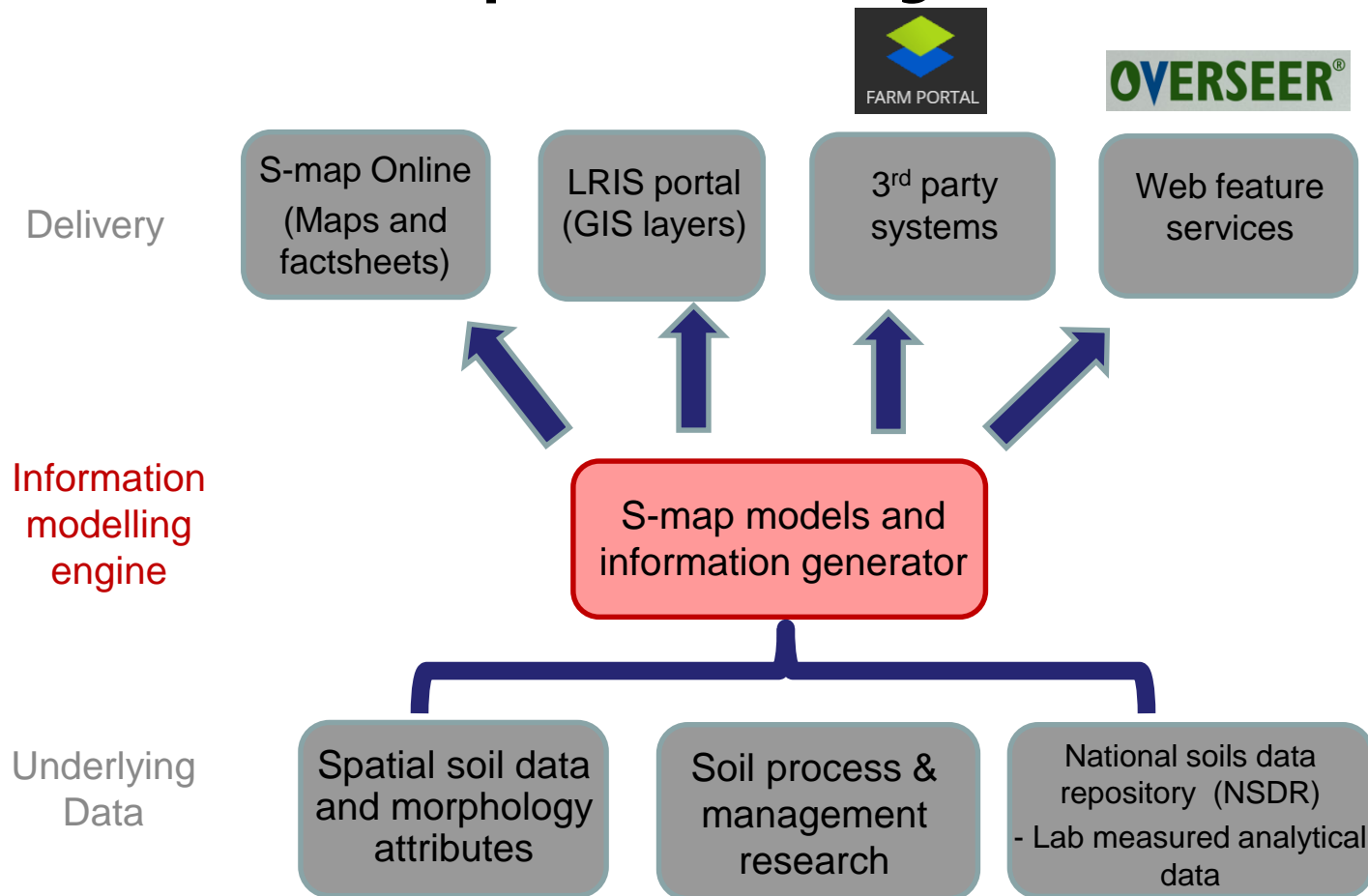
Soil C



Which one of these soil profiles has greatest versatility for highly productive land?



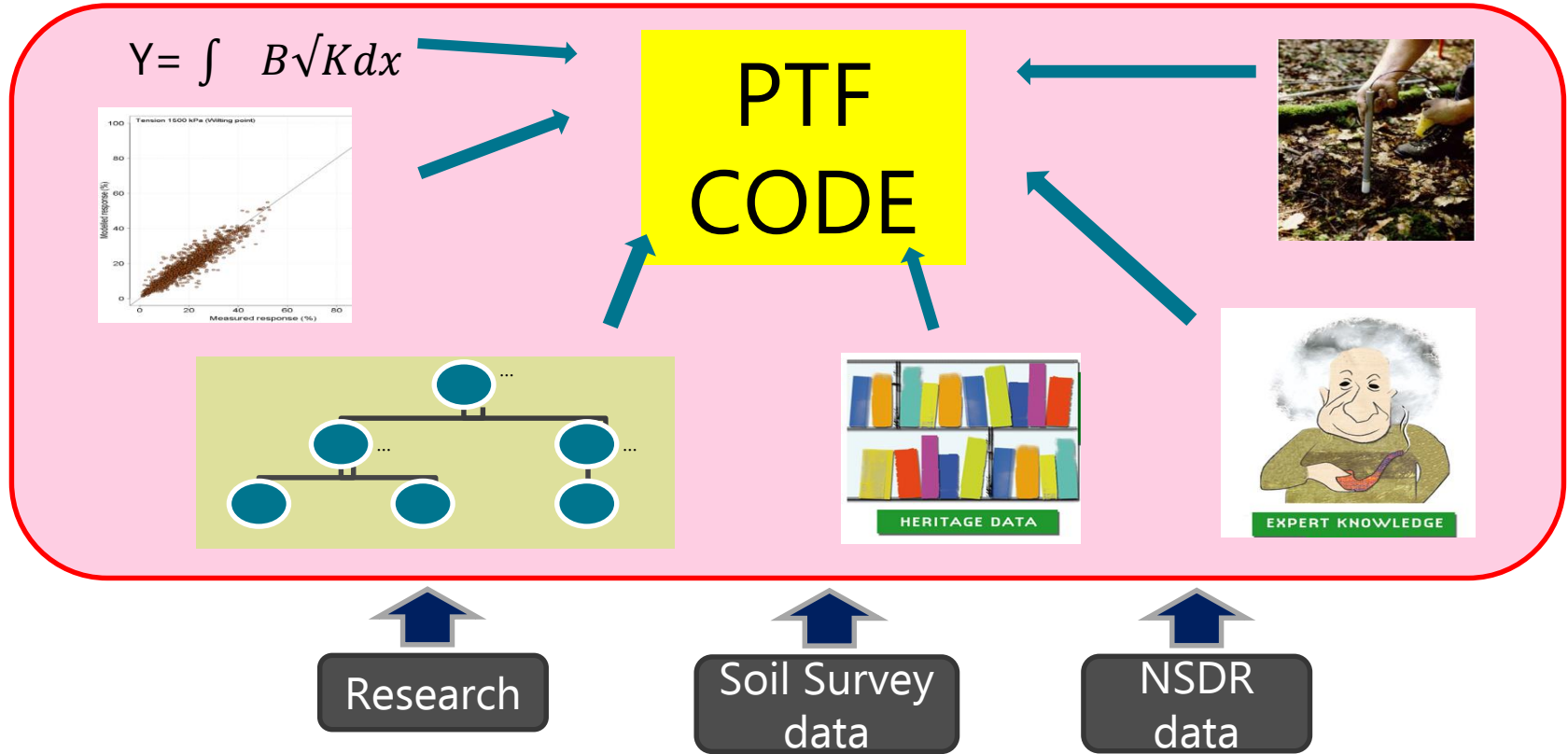
Part II: S-map inference engine



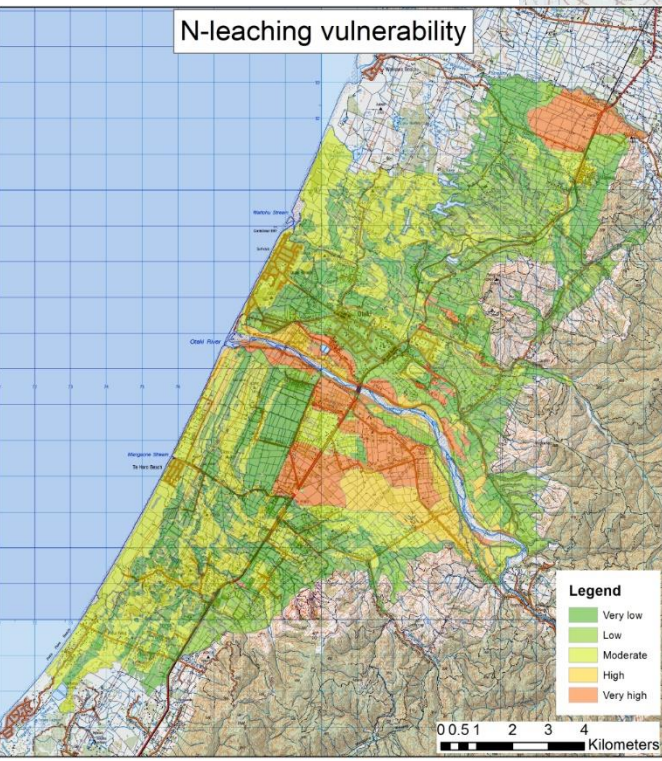
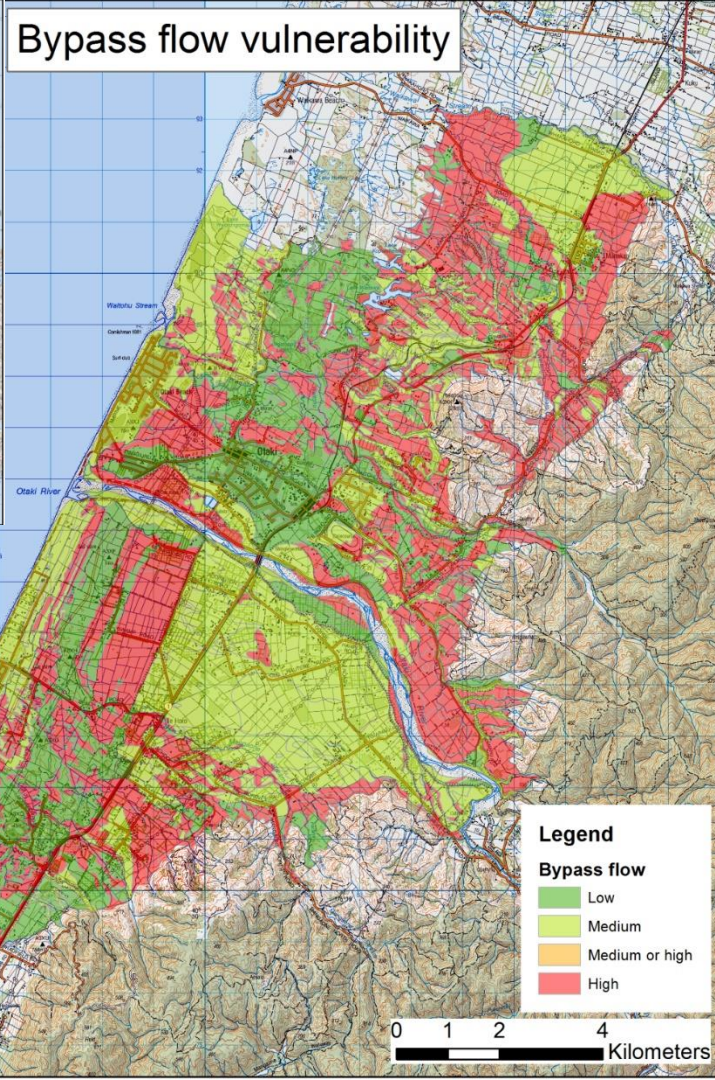
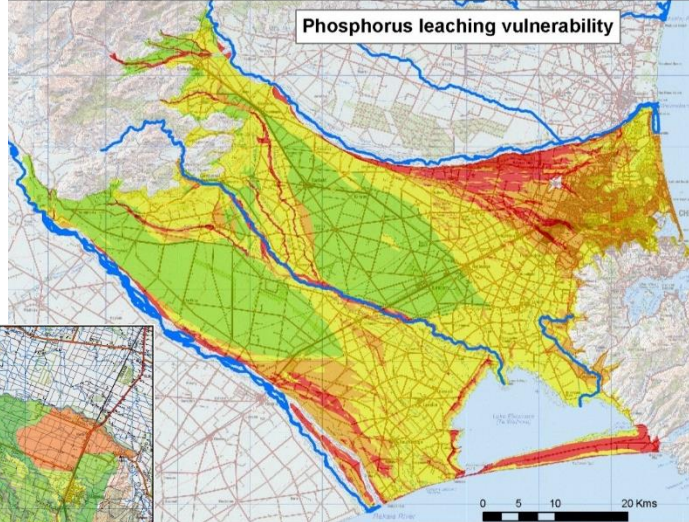
Soil information



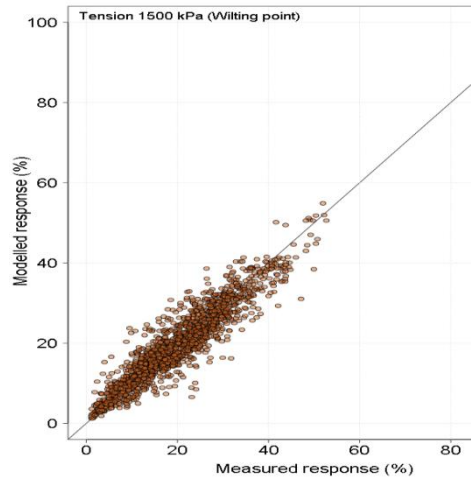
S-map inference engine



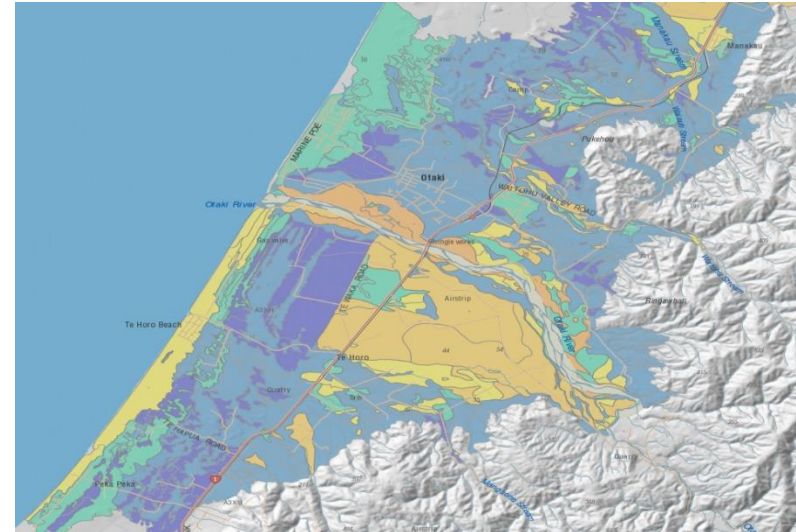
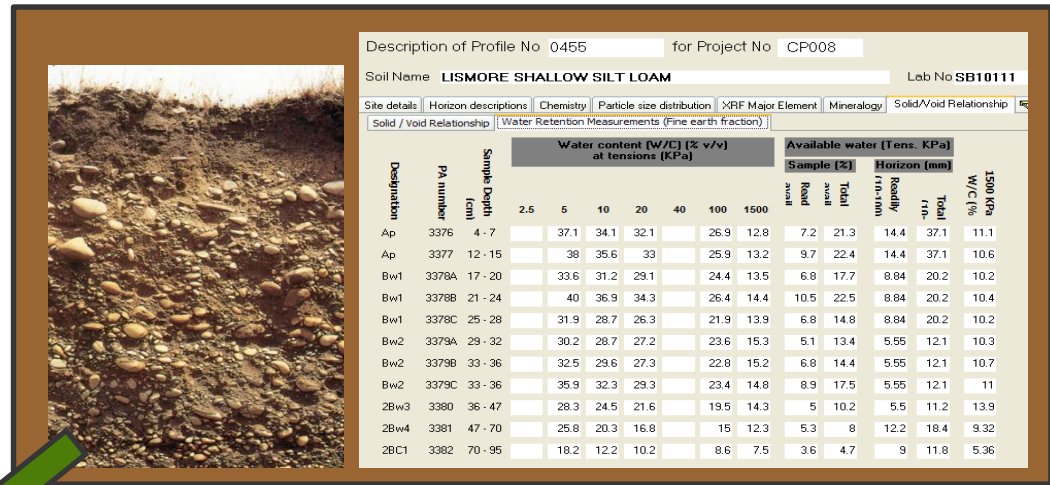
Risk mapping



NSDR = point measurements of soil attributes



S-map => spatial variability

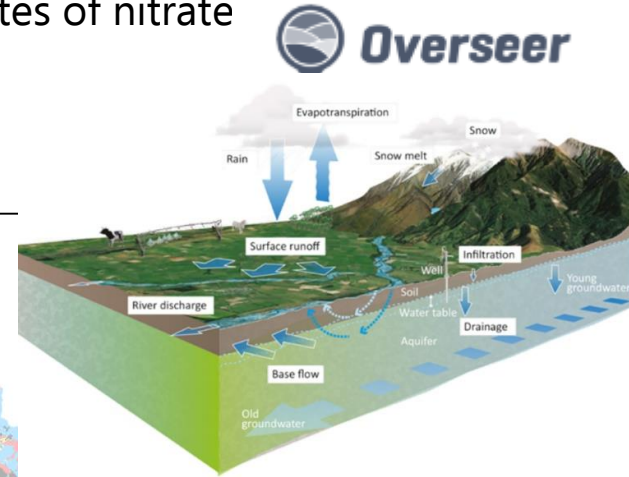
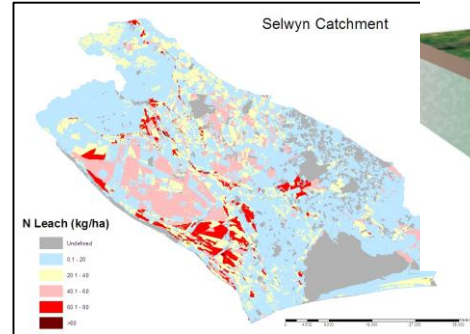




Predictions of the water retention curve gives us

PAW = profile available water, i.e., the capacity of the soil to store water. Essential for:

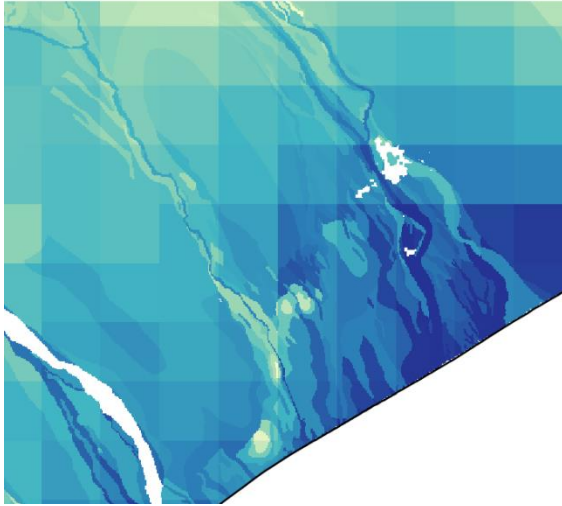
- Irrigation and effluent design / operation
- 9 soil moisture values for Overseer – essential for estimates of nitrate nitrous oxide emissions
- Soil hydrology parameters for NZWaM
- Coming: NZ Drought Index



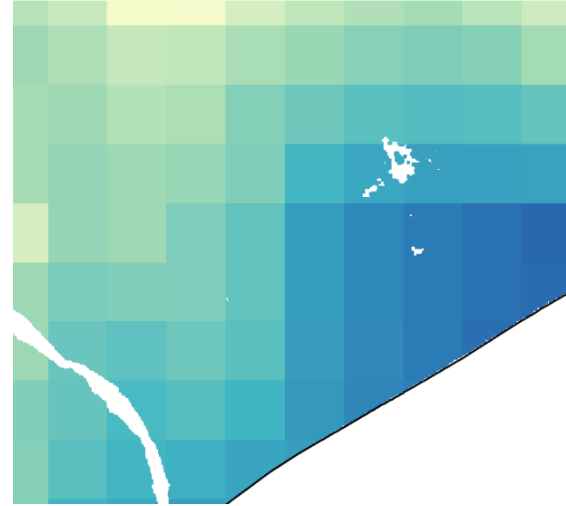


Droughtiness modelling

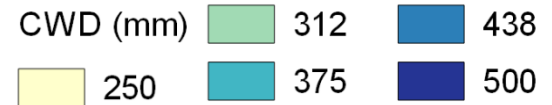
(a) 100 m S-map



(e) 5000 m nominal soil

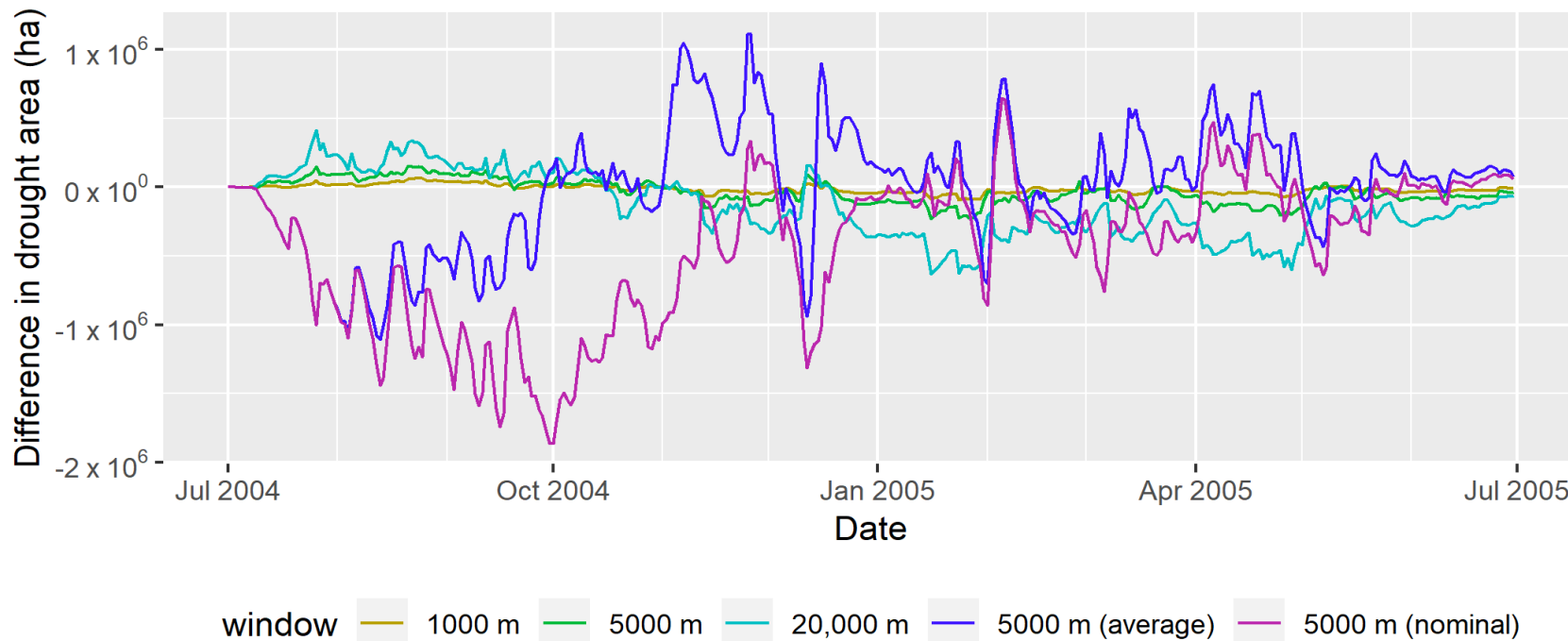


0 5 10 15 20 km

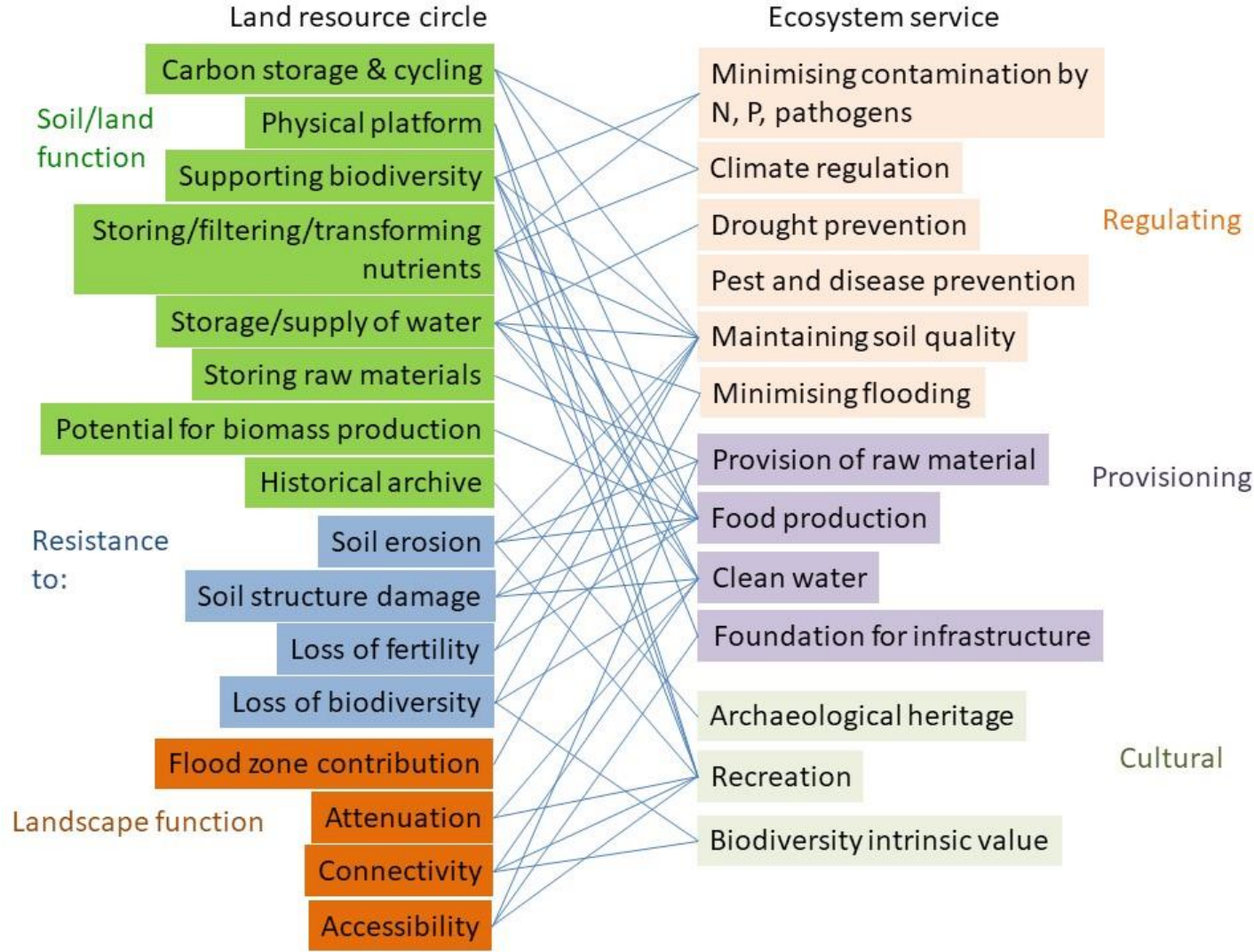




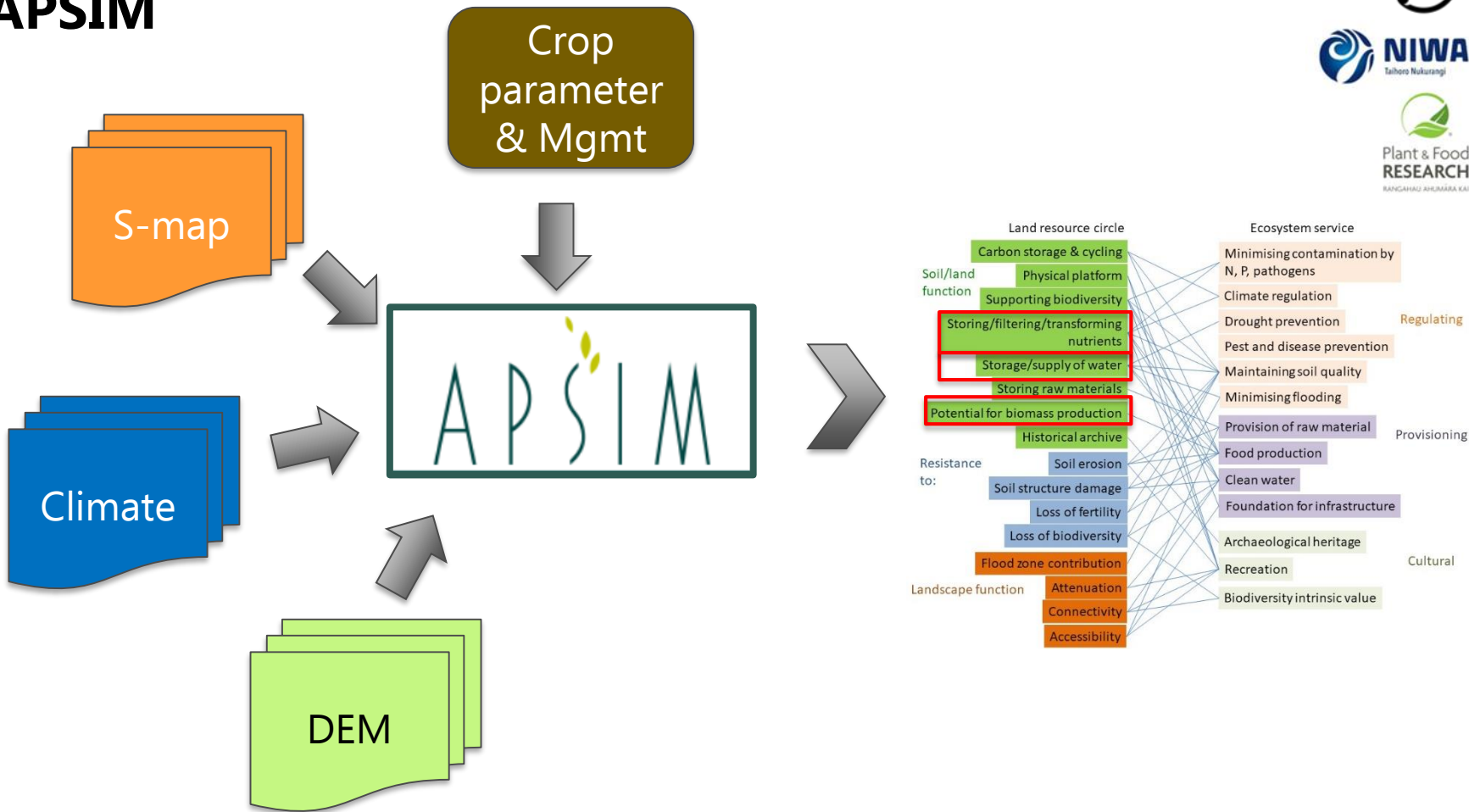
Droughtiness modelling



Natural Capital



APSIM





S-map Next Generation MBIE Endeavour programme

Major focus is soil hydrology – better understanding and mapping of water in soil

- Doubling measured points from 313 to c 700 sites
- New efficient and quantitative measurement techniques
- New modelling techniques
- New attributes (e.g. water movement)
- Effect of land management (artificial drainage, irrigation, cultivation)
- Effects of different types of stones on soil water storage

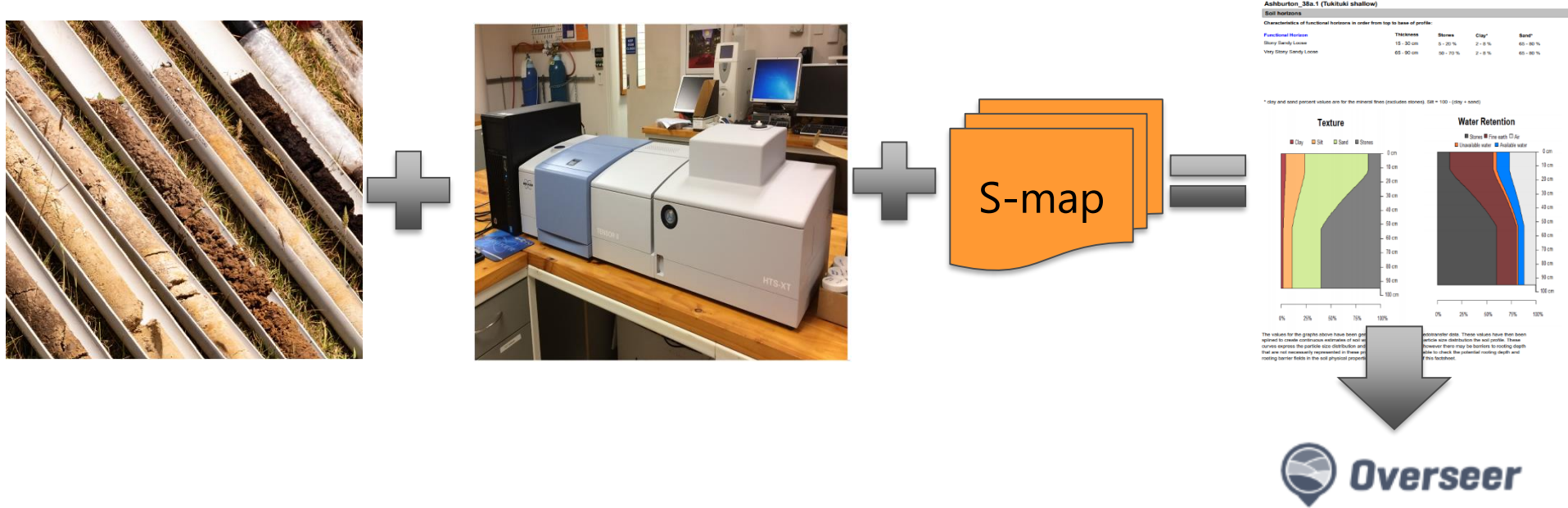


New PTFs (water storage, water movement, bulk density, cation and anion storage capacity, pH)



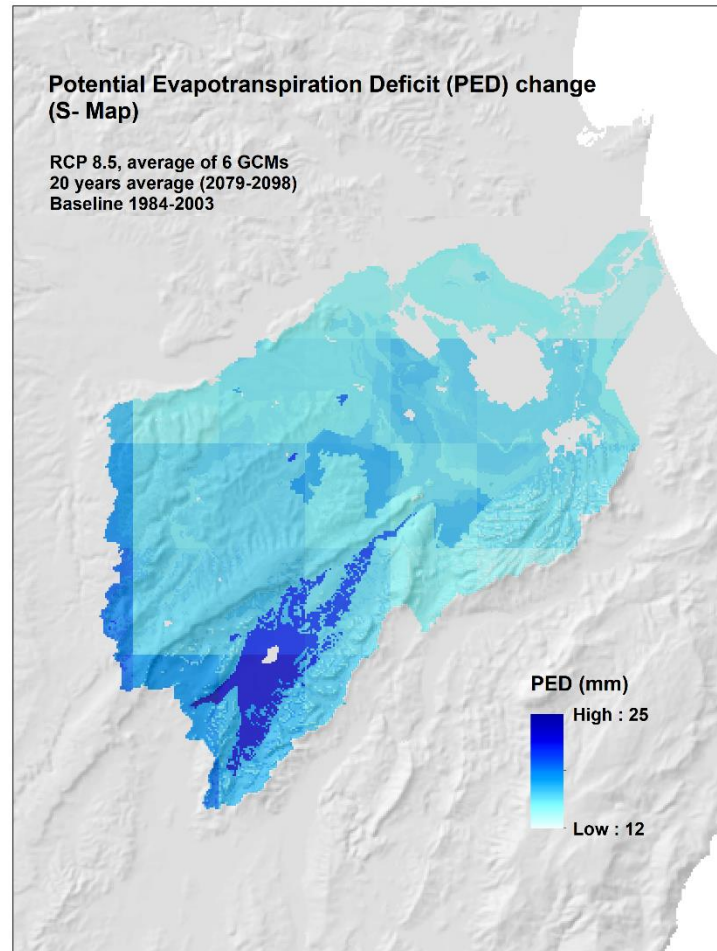
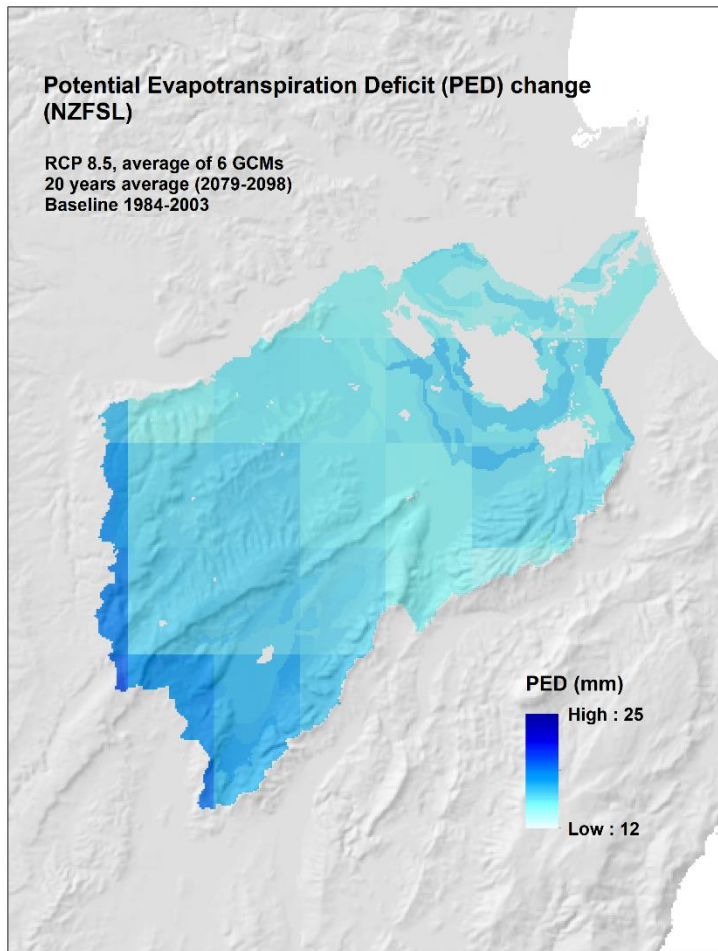
Farm scale tools

- Developing tools to bring power of the S-map inference engine to farm-scale



- Published with Regional Councils the NZ Soil Mapping Guidelines (2019)

What happens if poor quality soil info is used ...



Preliminary
crop
suitability
modelling



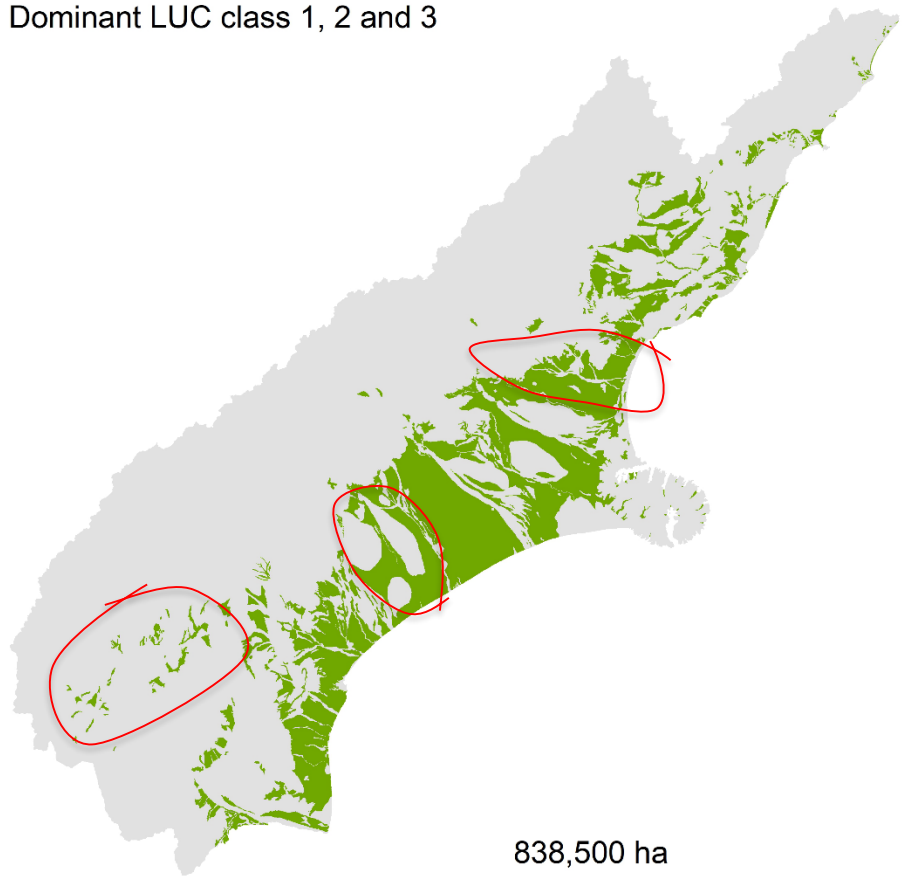
FSL

S-map

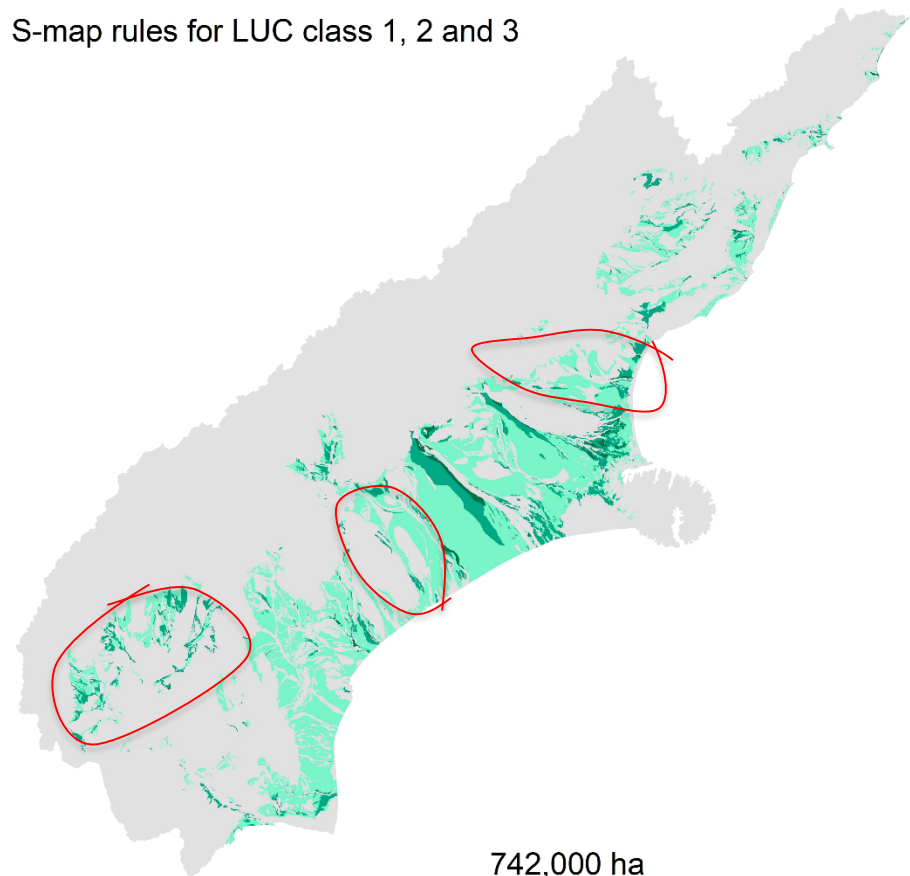


NPS HPL: Effect of updating LUC 1 – 3 map with S-map

Dominant LUC class 1, 2 and 3



S-map rules for LUC class 1, 2 and 3





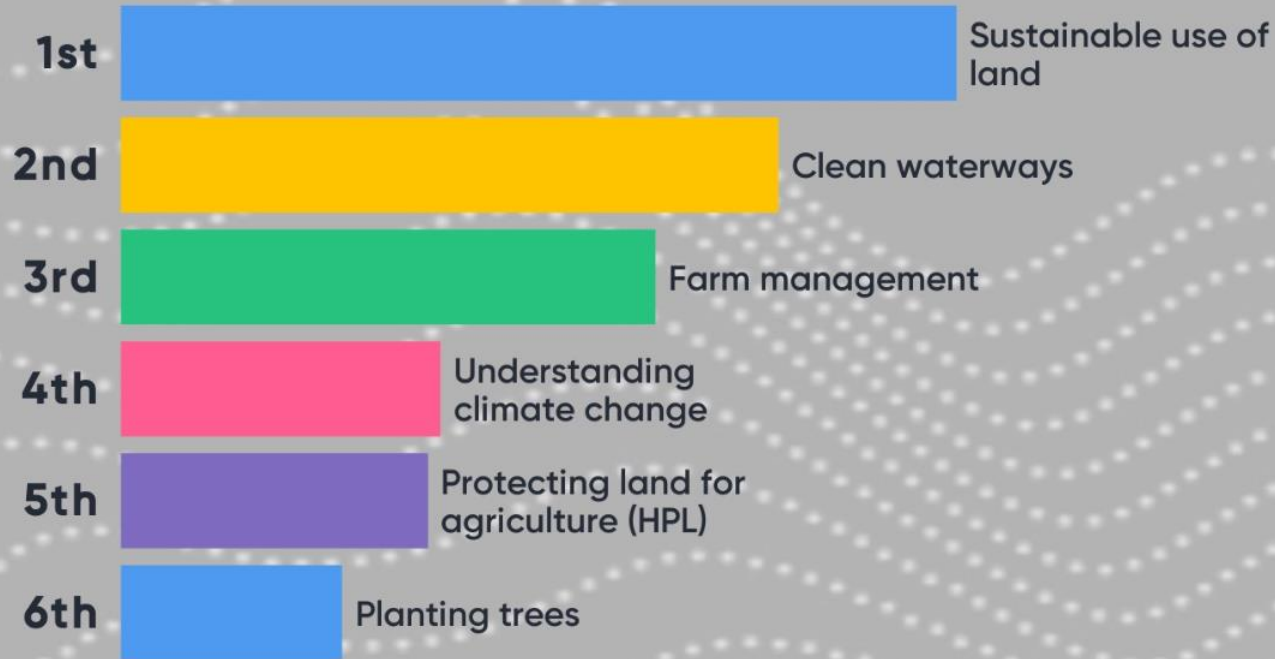
Part II: key take home message

Good science underpins transforming soil data into information & products. But quality information is needed to avoid expensive mistakes or lost opportunities.



Interactive Question 3: Rank the importance of the following uses of soil information from your perspective

Rank the importance of the following uses of soil information from your perspective:



Part III: Coverage of S-map

34% mapped = c. 8M ha

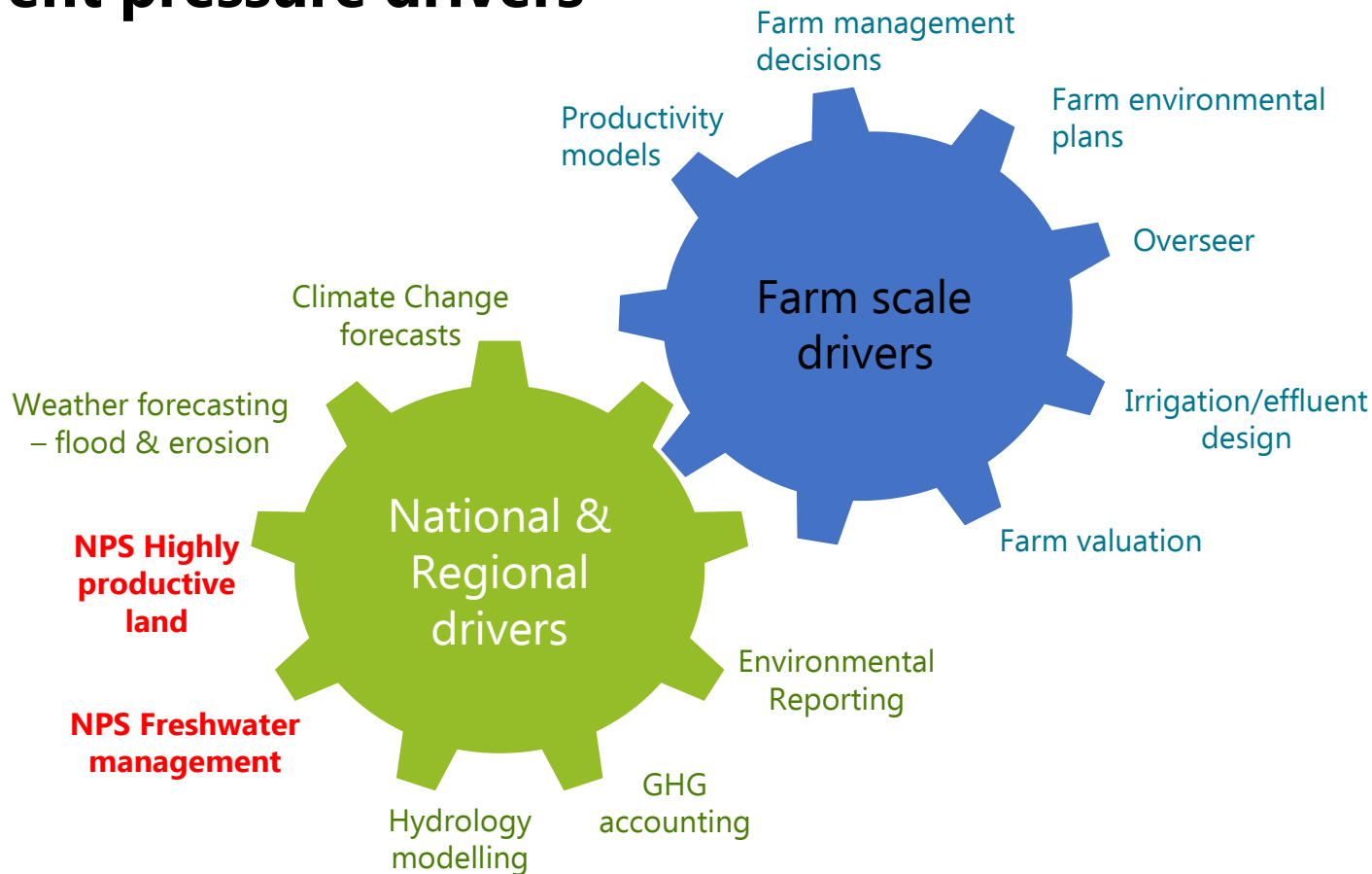
Tho 45% NZ is class 7 - 8

So we have covered 62%
of class 1 – 6 land

High diversity mapped
thus far, c. 5,000 soil types



Current pressure drivers

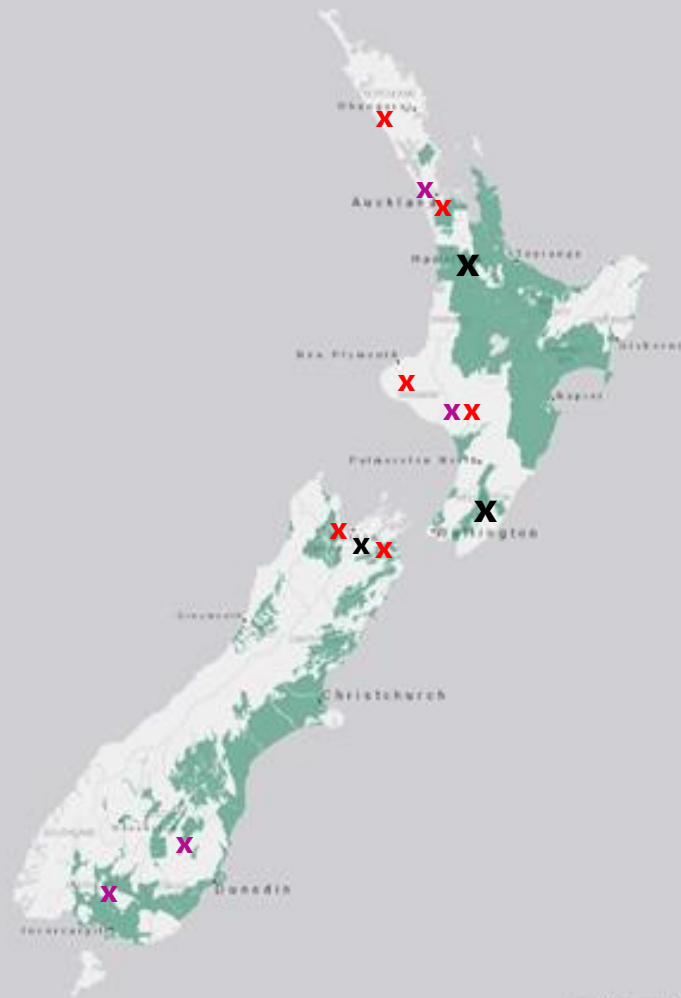


Pressure points for funding soil information

X = current mapping work

X = NPS HPL

X = Overseer



S-map funding streams

Regional Govt funding

Contestable funding, ~ 1 – 2 FTE (Mapping coverage)

Govt contestable open round funding

5yr Govt funding, all NZ contestable ~ 6 FTE (Science excellence & development)

Landcare SSIF funding

7yr Govt funding, internally competitive ~ 2 FTE (Infrastructure + modelling)

Nationally significant database & collections

Fixed funding ~ 1.5 FTE (NSDR database)

Commercial funding

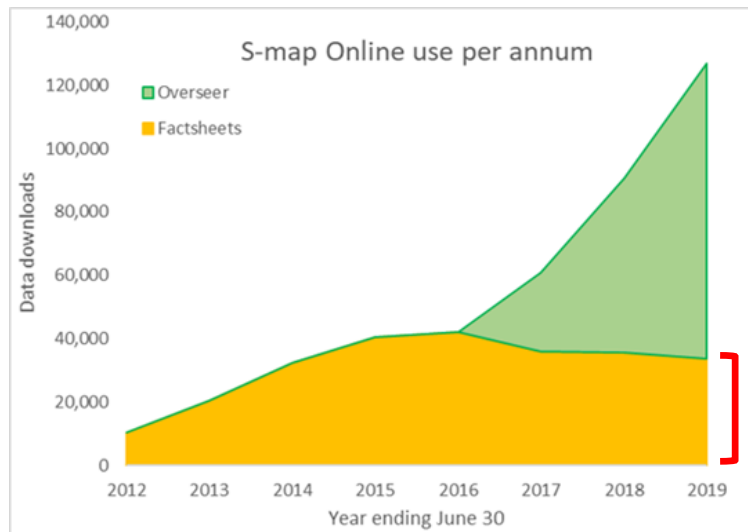
Annual data licence commercial users ~ 0.5 FTE (Data supply & maintenance)

Cost to complete

Land suitability	% NZ	% NZ <u>not</u> in S-map	Cost \$/ha	Estimated completion cost (\$M)
Multiple use	25	9	6	14
Pasture/forest	30	19	3	15
Class7 & 8	45	39	0.5	4
Total				34



Investment value

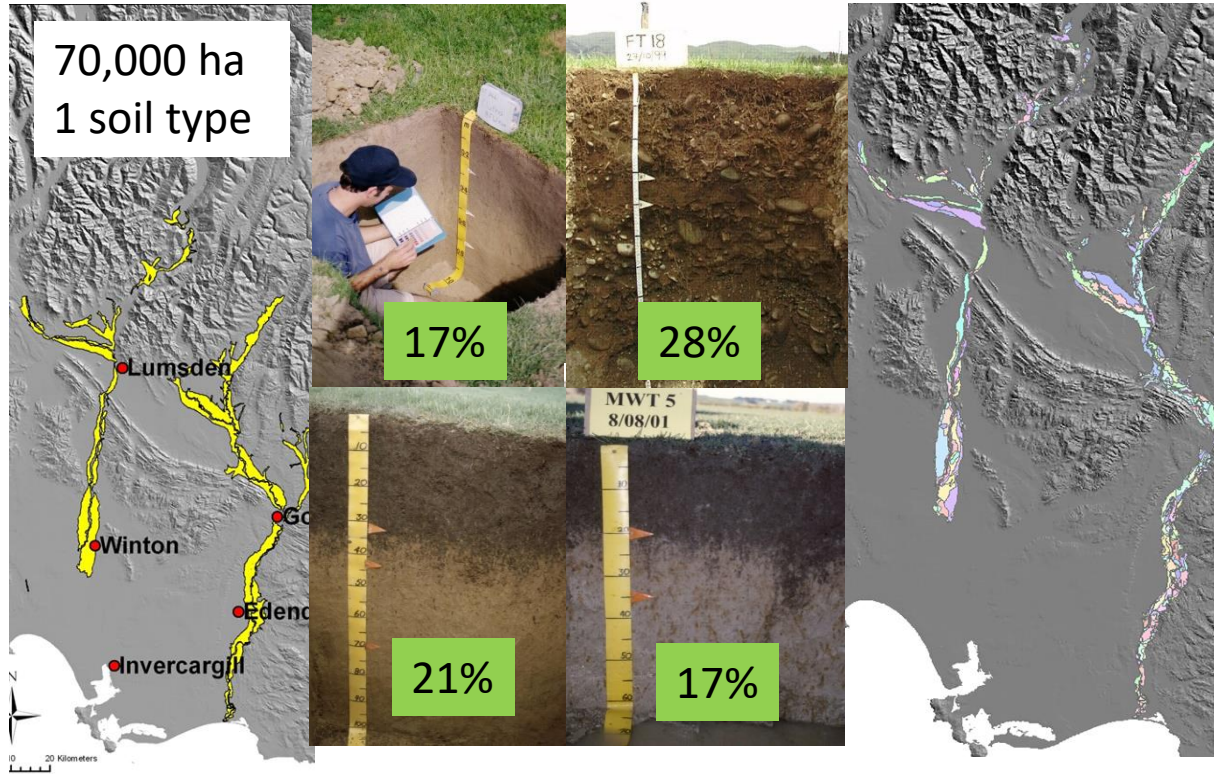


Market Economics 2019 analysis of S-map online users:

- Current direct benefits to users \$19.5M p.a
- Potential use value of completing S-map \$11.8M p.a.
- **Note:** Indirect Public benefits are additional, and there are many more users of S-map not covered in this survey

This is consistent with previous NZ and International CBA

Case study of CBA: Managing nitrogen leaching in Matura catchment



Spatially targeting mitigation to 25% dairy farms on hot spot soils:

- 30% mitigation efficiency
- CBR 1:6 in year 1

Benefits from N retained

- Farmer \$17/Kg/N/yr
- Community \$25/kg/N/yr



Completing S-map: Looking forward

Case is being developed for investment required to complete S-map:

- Briefing paper published for central Government (Oct 2019)
- User survey report (July 2019)
- Expected benefits assessment paper (Sept 2019)
- 1 page summary (today's A3 handout)

Aim is to provide evidence base for you and others to help us argue the case



Part III: key take home message

S-map contains information on one of NZ's most important natural resources. Ongoing financial support for this information system is a critical investment in NZ's future.



Interactive Question 4: What are your ideas for making this investment happen?

Who should we/you talk to?

What else do we need to prepare?

Suggested next steps?

Many thanks to everyone who participated in this interactive seminar. The information provided will be used in our planning.

To keep the conversation going please contact
Sam (carricks@landcareresarch.co.nz) or
Linda (lilburnel@landcareresearch.co.nz)