LAND & WATER SCIENCE

High-Resolution Radiometric Soil Mapping

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Why is accurate landscape knowledge important?

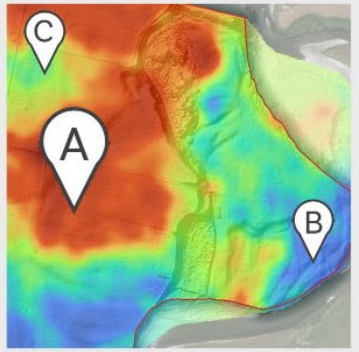
Radiometrics is a tool for improving accuracy and understanding of your landscape.

The radiometric survey process for soil mapping

THE SURVEY PROCESS

Drive the radiometric sensor over the property. The sensor detects naturally occurring gamma radiation emitted from the earth.

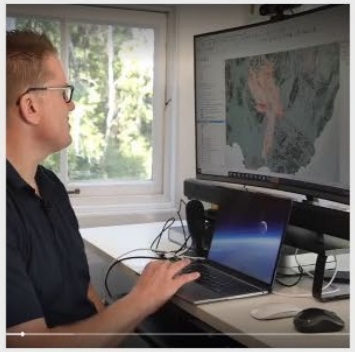
The trail on the map shows where the sensor was driven. Each dot represents a data capture point.



The radiometric maps of landscape variability are validated by ground truthing.

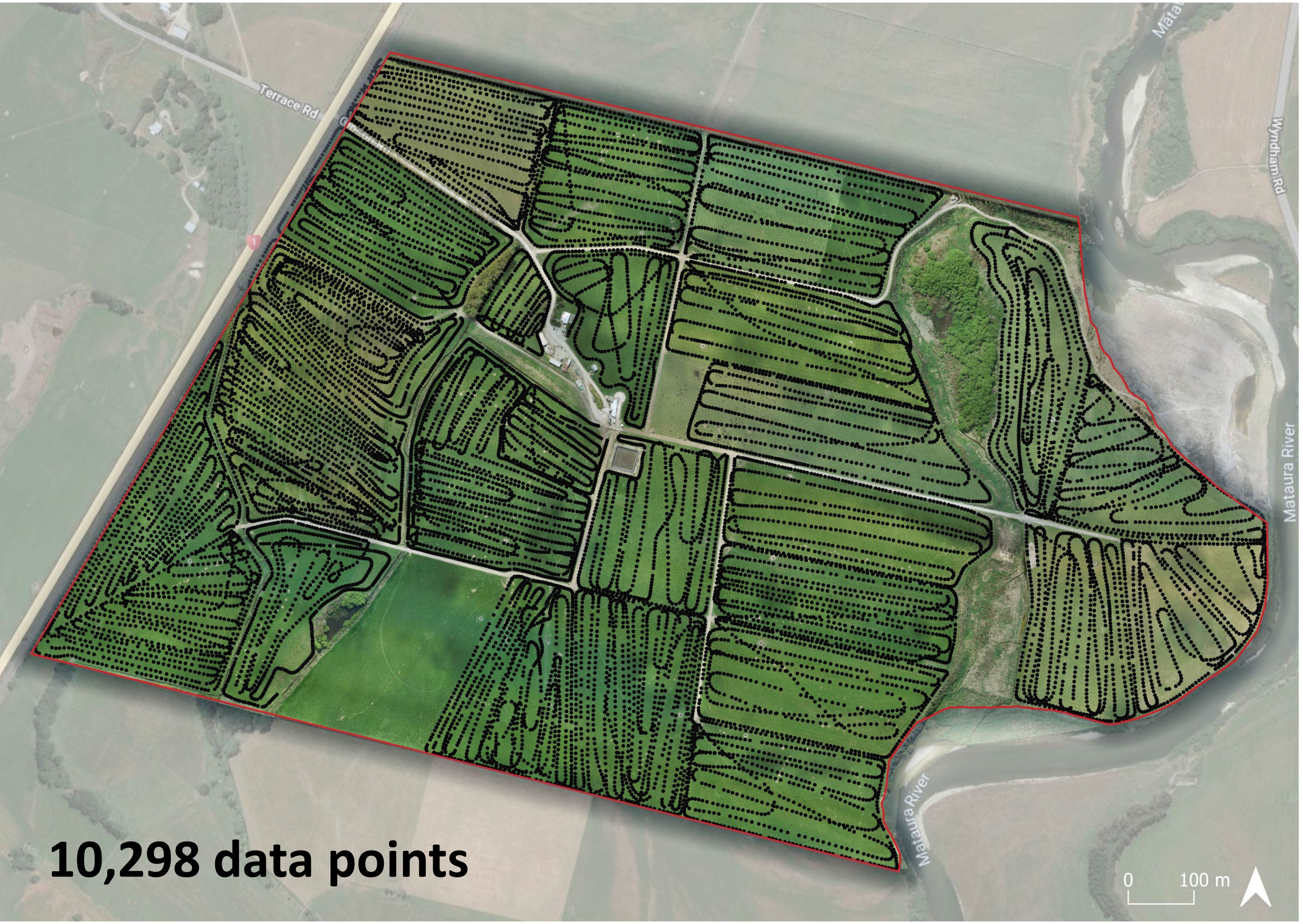
Ground truthing involves excavating soil pits approximately 1m deep to analyse the soil profile and make sure the data matches what is actually in the paddock.

LANDSCAPE AND SOIL TYPE MANAGEMENT ZONES



One of the science team members processes and analyses the soil type data before producing the new data driven soil type management zones map.

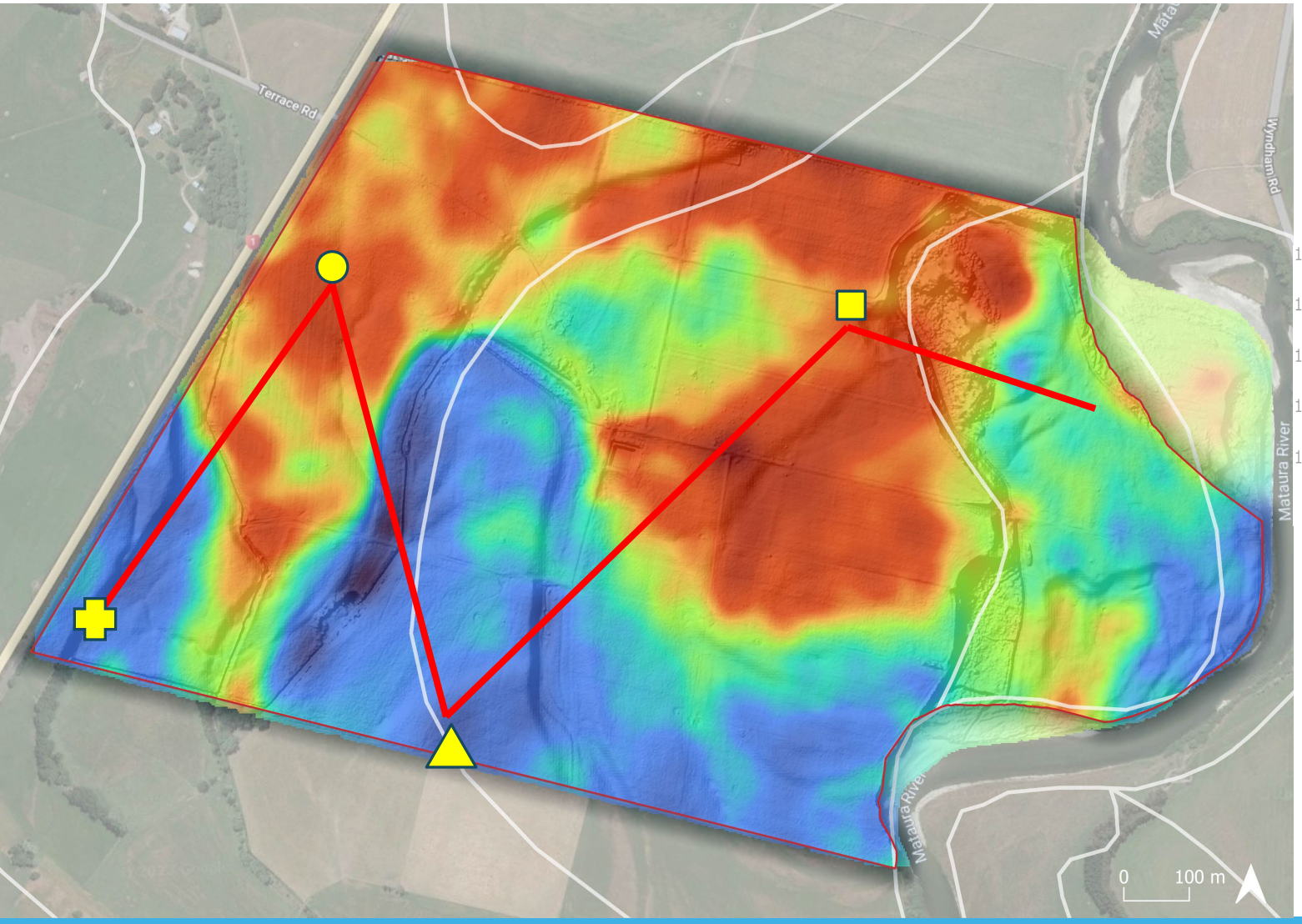
High-resolution radiometric soil & geological survey (20m)

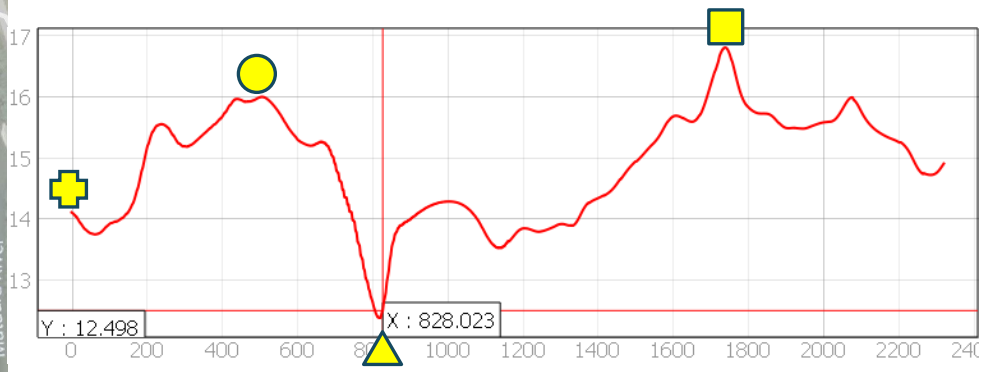


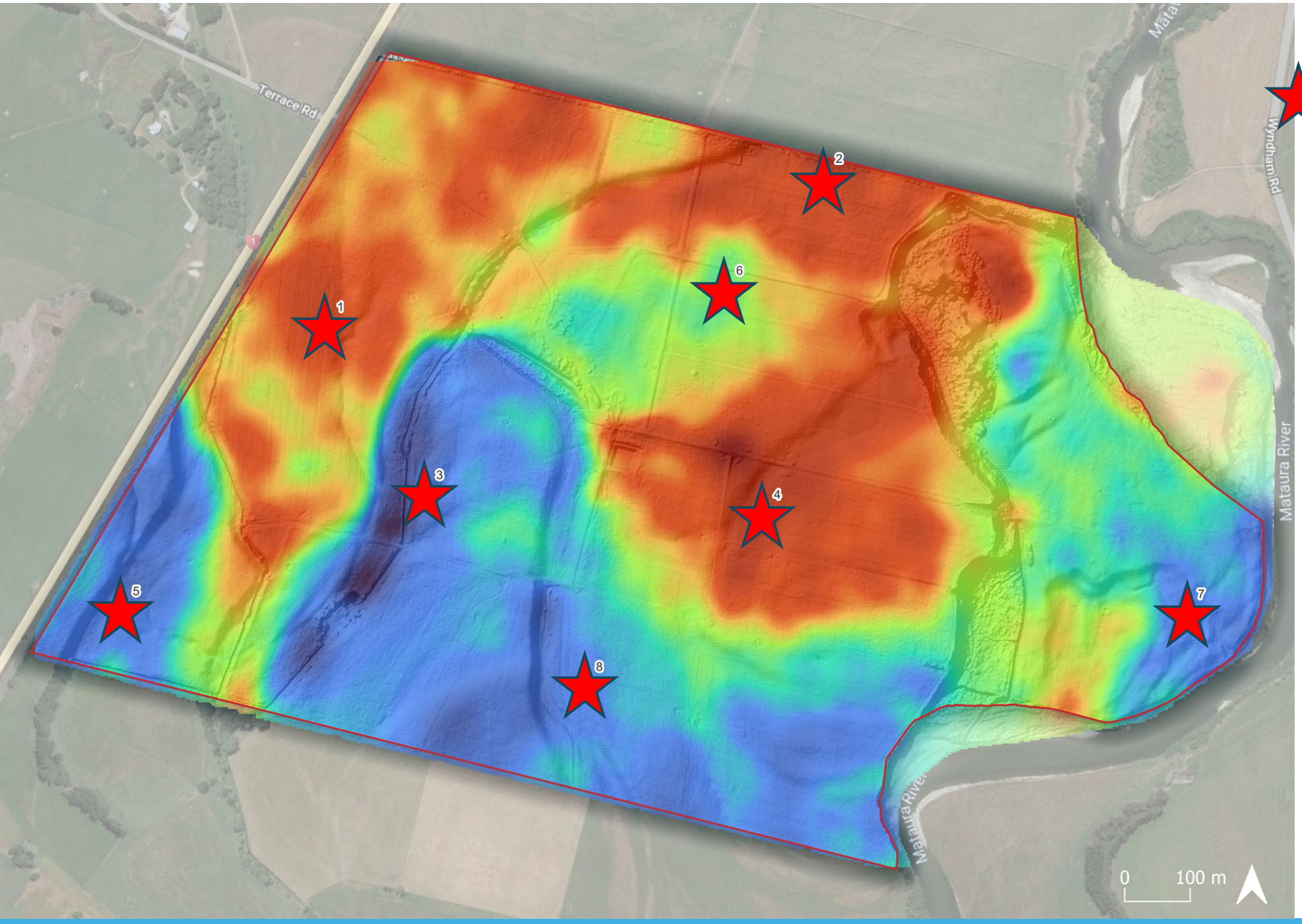
Detects:

- Soil texture
- drainage class
- bulk density
- organic carbon
- soil chemistry
- volumetric water content

There is a lot of variability across the property







Ground truthing sites at Brydone property

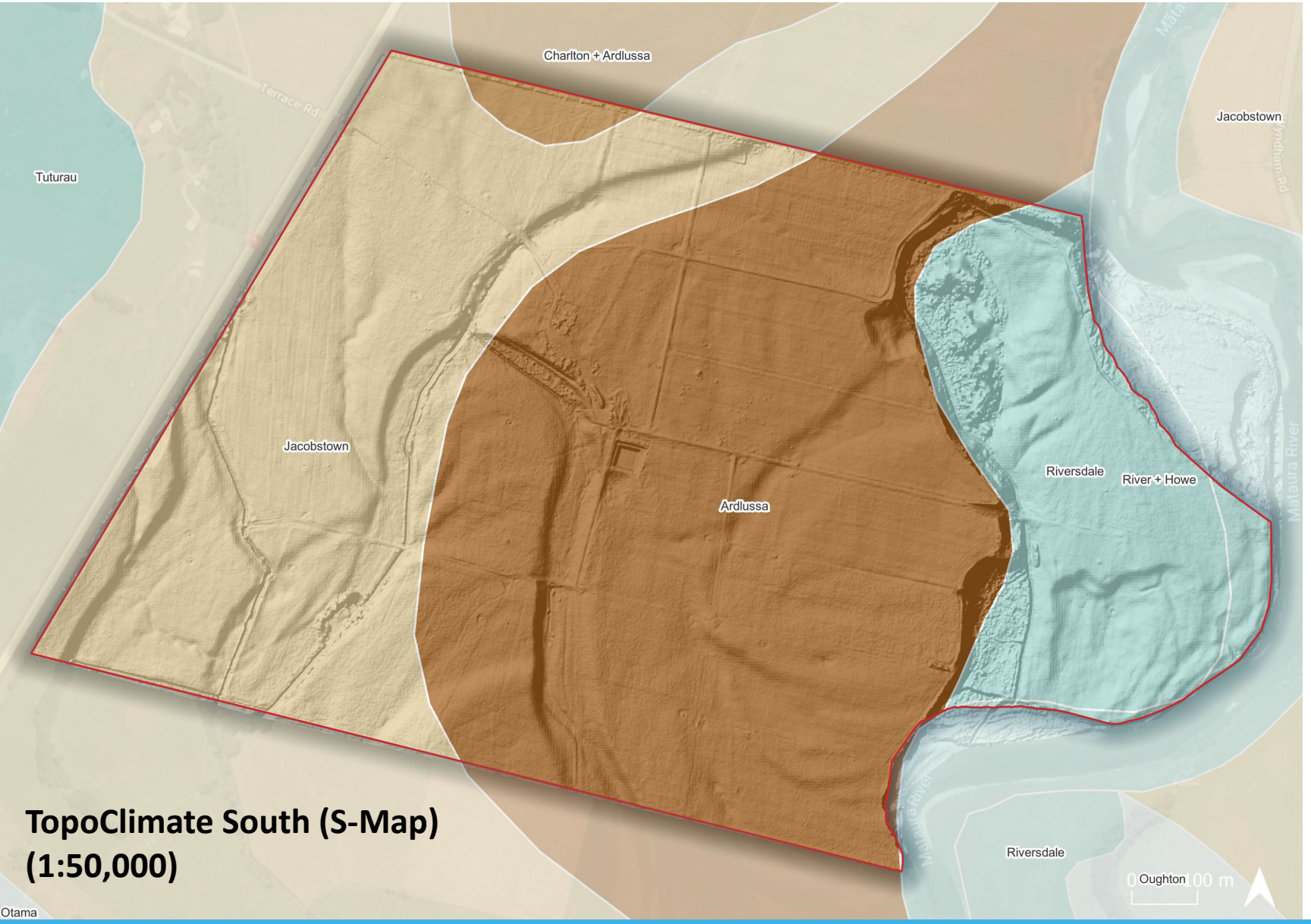
Selected according to radiometric signals:
K, U, Th, Cs, Th/K, TC

Digging holes and analysing the soil profile to make sure the data matches the physical landscape

Ground truthing revealed:

1. Peat over silt
2. imperfectly drained gravels
3. poorly drained silt
4. well drained silt over gravels

OLD - Incorrectly Mapped Soils

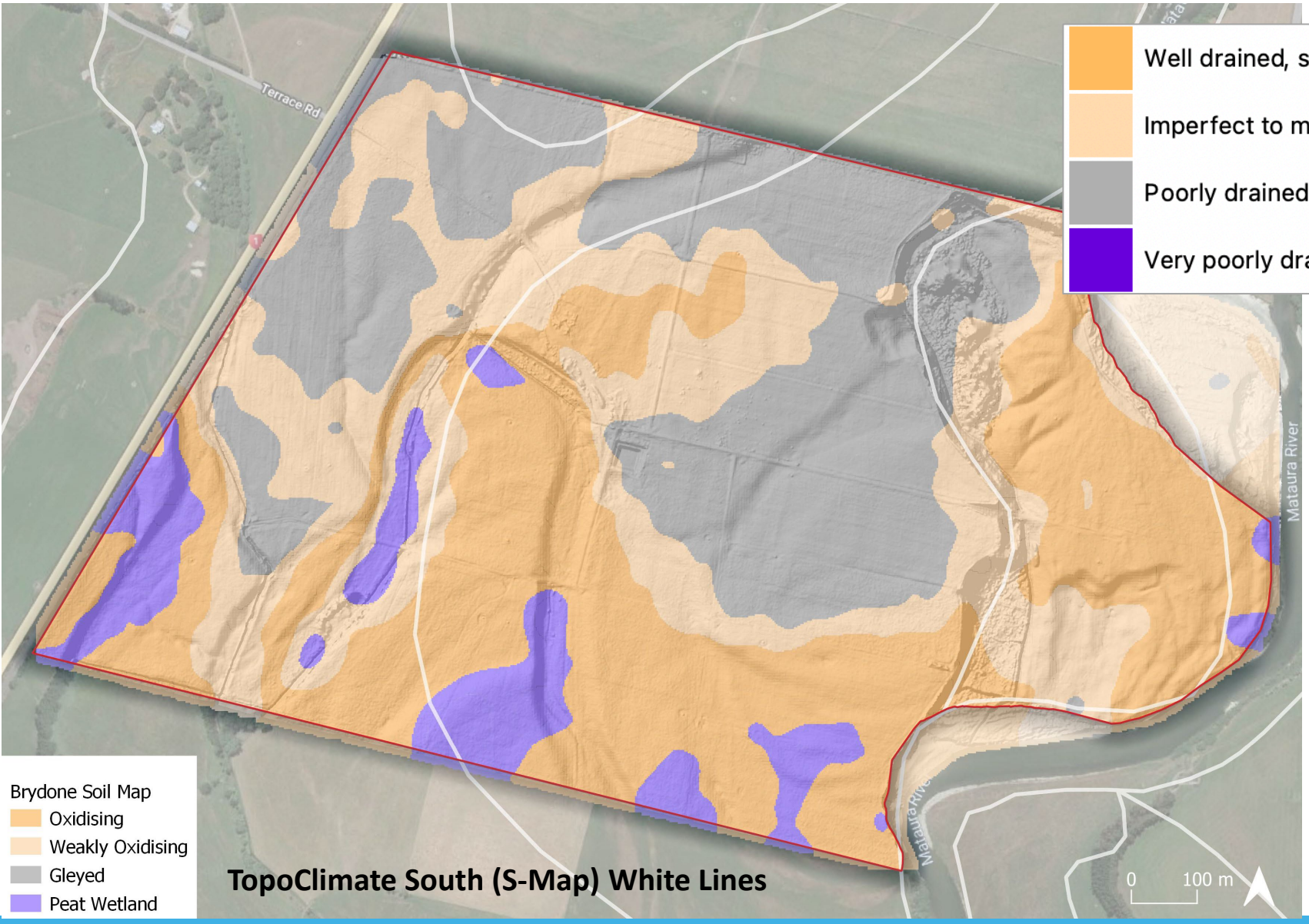


TopoClimate South (S-Map) (1:50,000)

TopoClimate South/S-Map identifies 3 main soil types

- Acid Orthic Gley (Pukemutu type) – Poorly drained
- Pallic Mottled Firm Brown (Wynd type) – Poorly drained
- Acidic Orthic Brown (Eureka type) – Well drained

NEW - Refined, Data Driven Soil Map



Significant errors in S-Map soil map observed at Brydone property.

Previously unrecognised areas of peat and significant variation in the drainage status of Eureka (gravel) soils.

Big implications for sustainable management.

If you think your soils are inaccurately mapped, get them surveyed!

High-Resolution Radiometric

Soil Chemical Mapping for variable rate fert spreading

“Only use what you need.”

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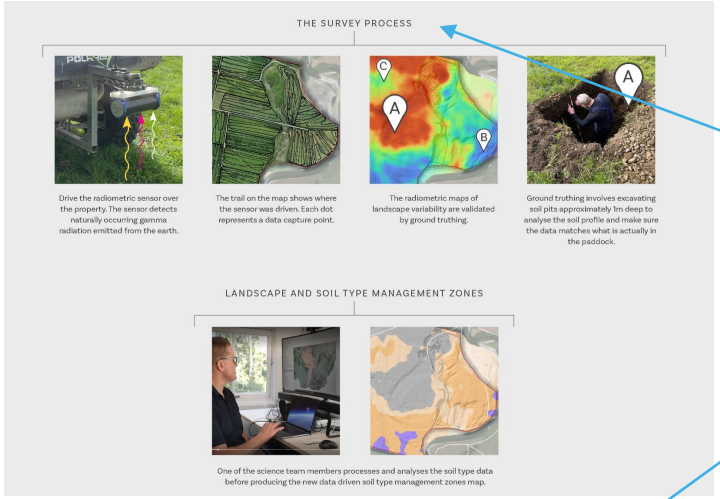
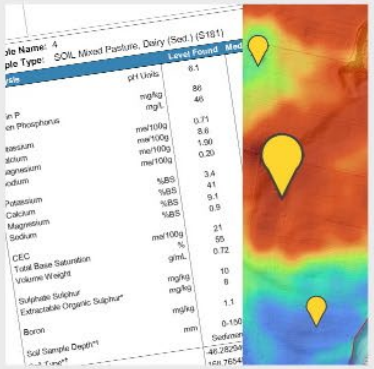
Process for developing variable rate fert zone maps and file types



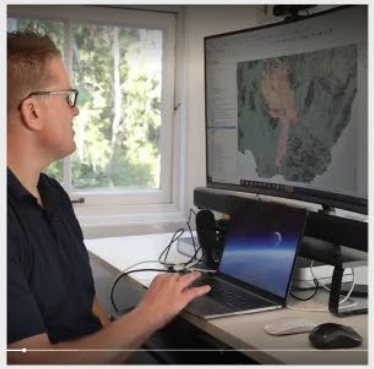
Process for soil mapping

PLUS soil chemistry analysis

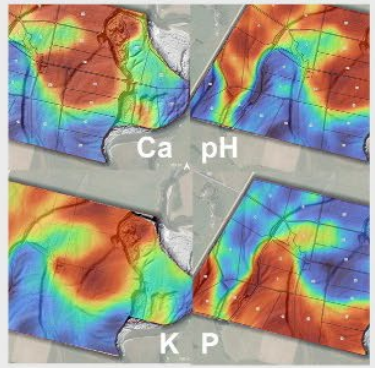
SOIL CHEMISTRY ANALYSIS



GPS marked soil test data is compared and analysed alongside the radiometric outputs.

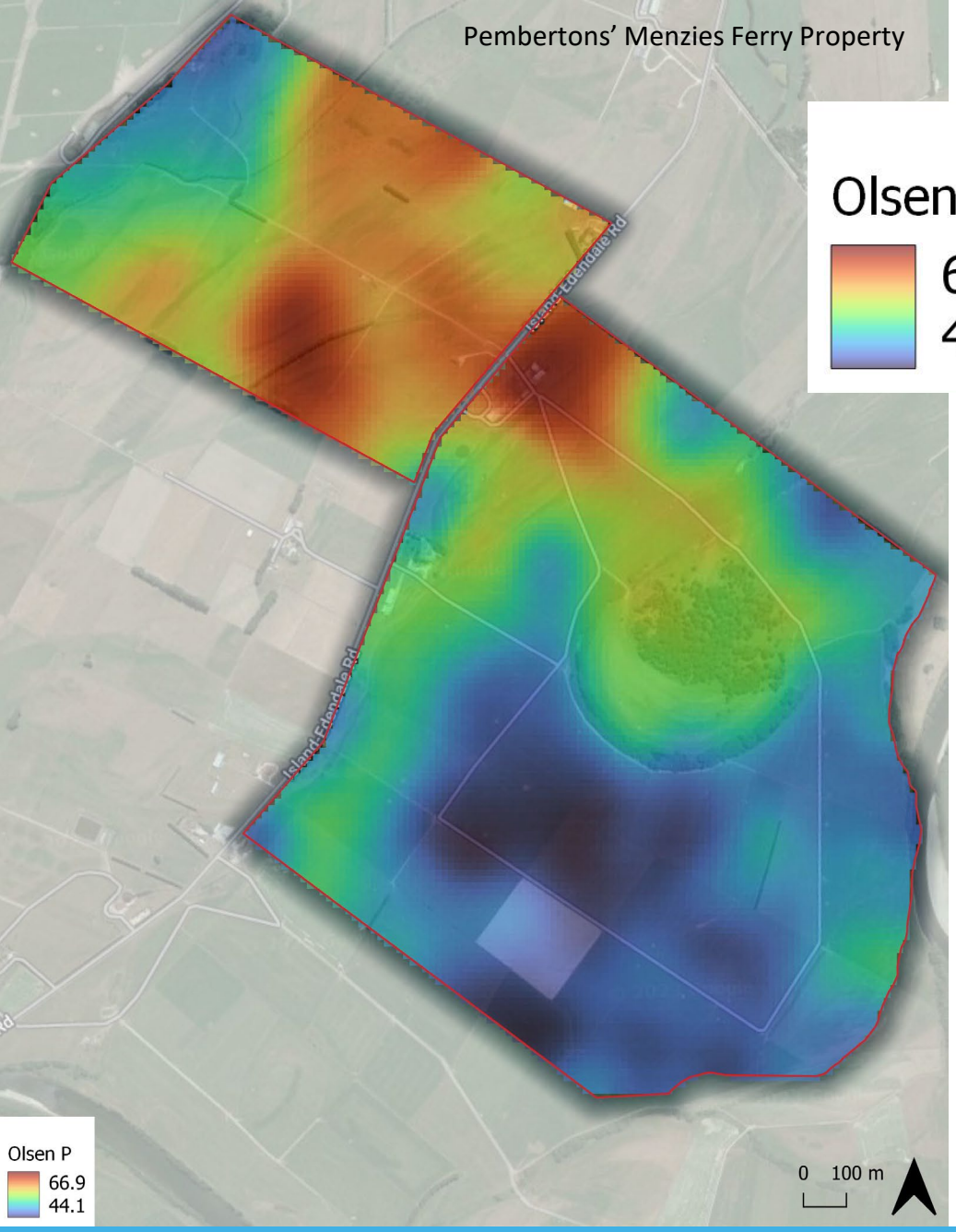


The relationship between the radiometric maps and soil test data is modelled and maps of soil chemistry produced.

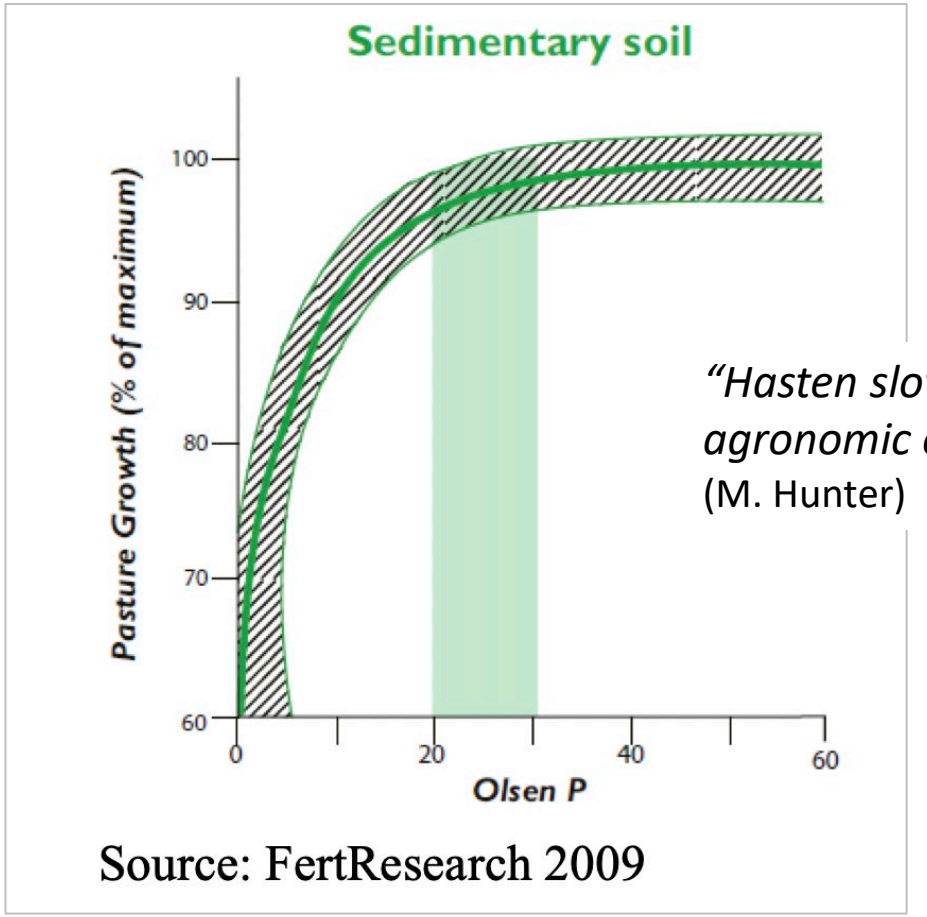


Soil chemistry maps are then further analysed for translation into other outputs.

Zone maps and file types compatible with software that powers variable rate fertiliser application or irrigation are produced.

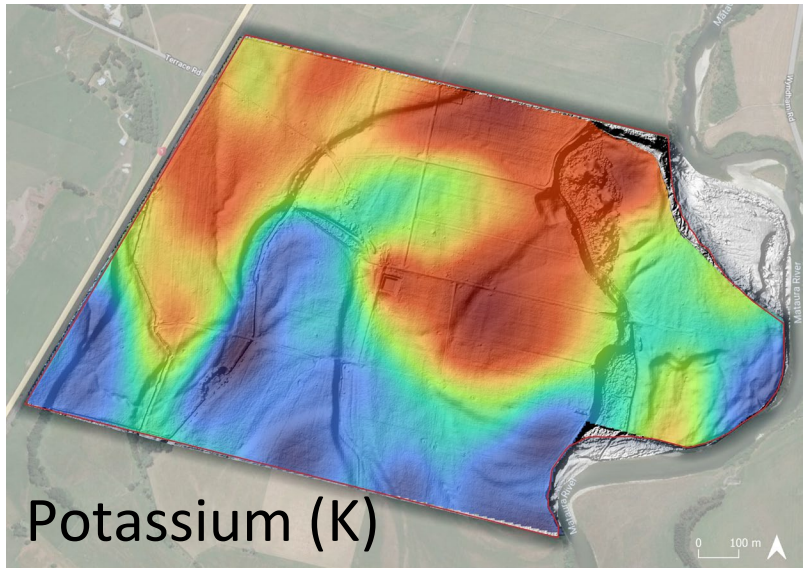


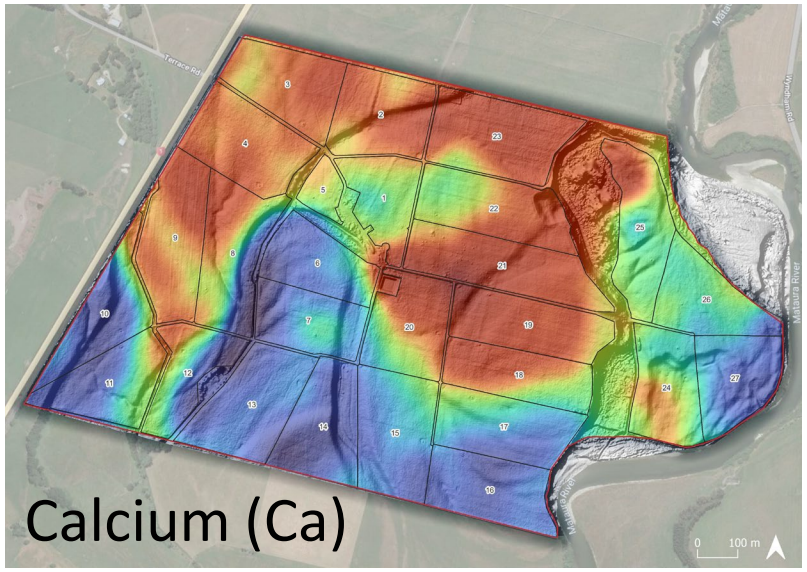
Historic area of FDE irrigation has high Olsen P (and K)

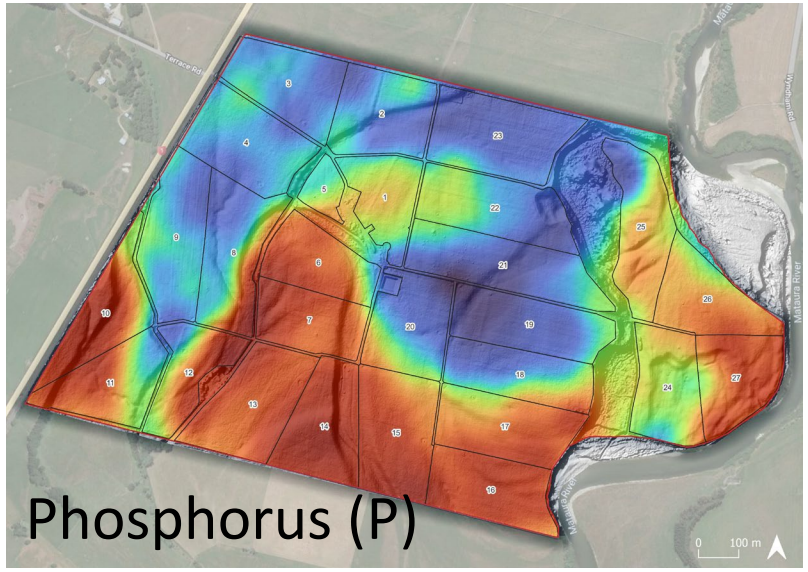


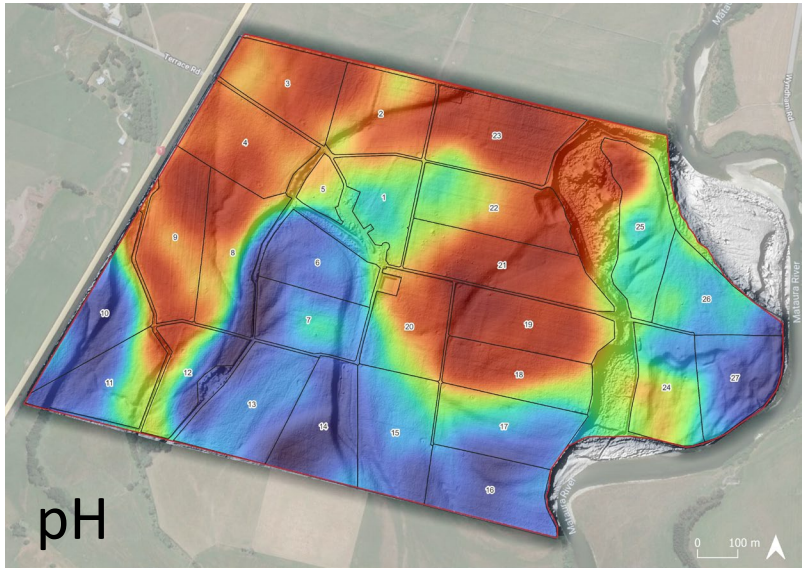
"Hasten slowly towards agronomic optimum"
(M. Hunter)

Examples of variation in soil chemistry signals









Data packaged

pH, CEC, TEB, K, SO_4, OS, SOC, Olsen P etc

Fertiliser Zone Map

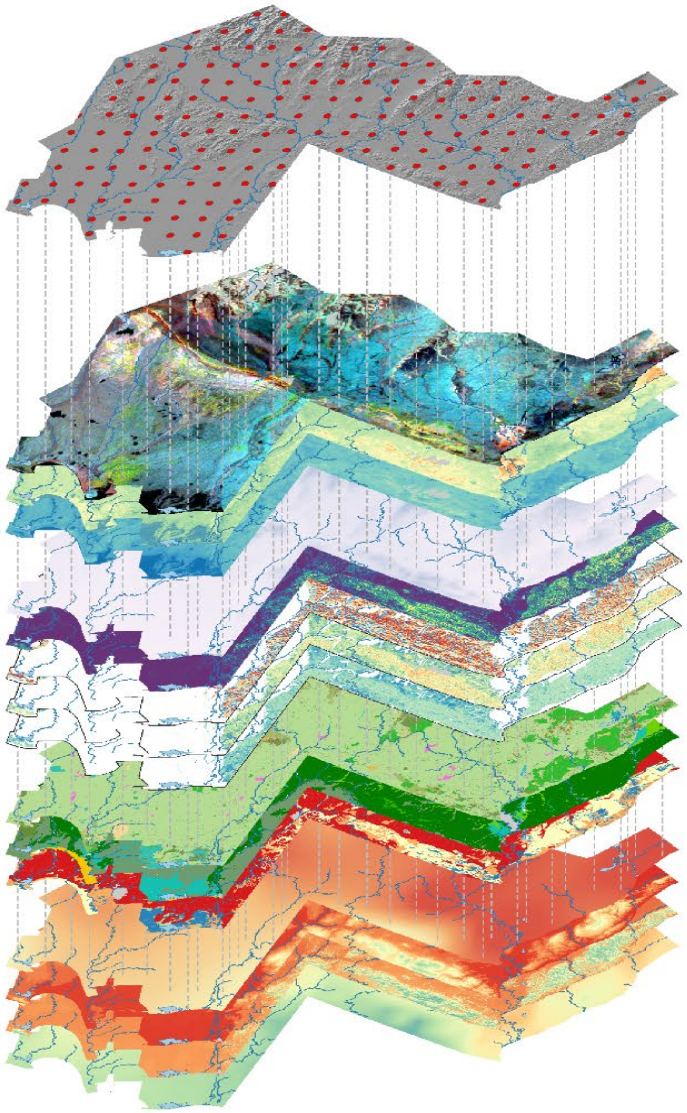
- Zones show areas where soil and soil chemistry differ
- Visual example of file information that informs variable rate fertiliser application

Questions?

Data Input

A Observational Dataset

B Raster Library



Predictive Model Development

C Numerical Model

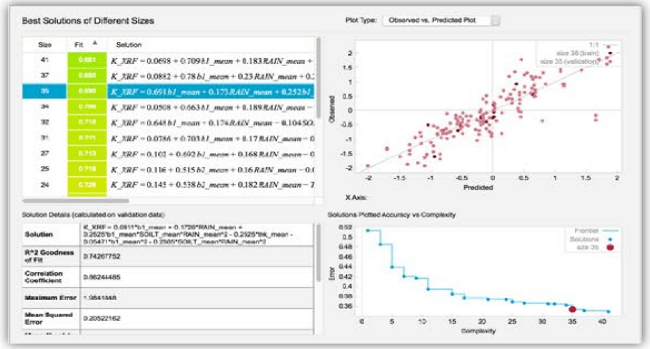
Genetic Programming

Model input data							

D Machine Defined Symbolic Regression

Model Search Function:

K_XRF = f(b1, b2, b3, thk, RAIN, SOILT, TEMP)



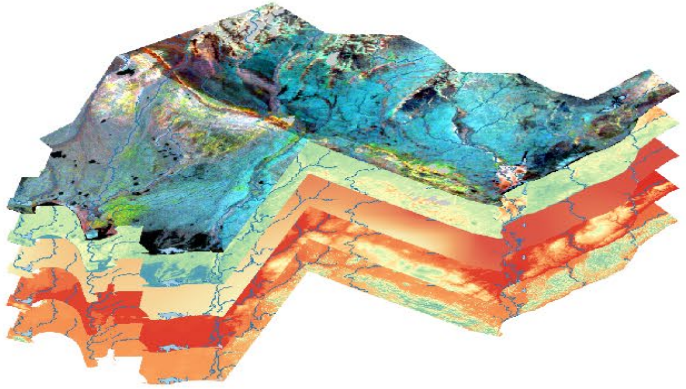
Explicit Mathematical Function:

K_XRF = 0.69*b1 + 0.17*RAIN + 0.25*b1*SOILT*RAIN^2 - 0.25*thk - 0.055*b1^2 - 0.288*SOILT*RAIN^2

Predictive Map Generation

E Raster Calculator

K_XRF = 0.69*b1 + 0.17*RAIN + 0.25*b1*SOILT*RAIN^2 - 0.25*thk - 0.055*b1^2 - 0.288*SOILT*RAIN^2



F K_XRF Map