Whenua Haumanu

Nurturing the land through exploring pastoral farming

Program Overview

Danny Donaghy – Whenua Haumanu Program Lead

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

Ministry for Primary Industries
Manatū Ahu Matua

What is Whenua Haumanu?

“Nurturing the land through exploring pastoral farming”

New Zealand’s most comprehensive program on the effects of contemporary and regenerative pastoral practices

Funded primarily by the Ministry for Primary Industries, in partnership with Massey University ~$27M

7-year program brings together universities, Crown Research Institutes and industry partners to scientifically assess the suitability and relevance of regenerative agriculture in New Zealand

Focus on capacity building – 29 postgraduate students currently (3 years in)

Whenua Haumanu Partnership

Ministry for Primary Industries
Manatū Ahu Matua

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

Research Partner Collaboration

LINCOLN UNIVERSITY
Te Whare Wānaka O Aoraki

Manaaki Whenua
Landcare Research

agresearch
āta mātai, mātai whetū

Riddet Institute
Kōkiri - Te Hā o te Kai

Industry Involvement

BARENBRUG

PGG Wrightson Seeds

Hill Laboratories
TRIED, TESTED AND TRUSTED

AGRICOM
Pastures for Profit

LIC
LIVESTOCK IMPROVEMENT

The T.R. Ellett
Agricultural Research Trust

Fertiliser Association
Shaping profitable and sustainable farming

DairyNZ

PĀMU

On-Farm Research

AGFIRST

Dairy Trust
TARANAKI

Fonterra

FOCUS GENETICS

SILVER FERN FARMS

TE AO TUROA
ENVIRONMENTAL CENTRE

beef+lamb
new zealand

Halter

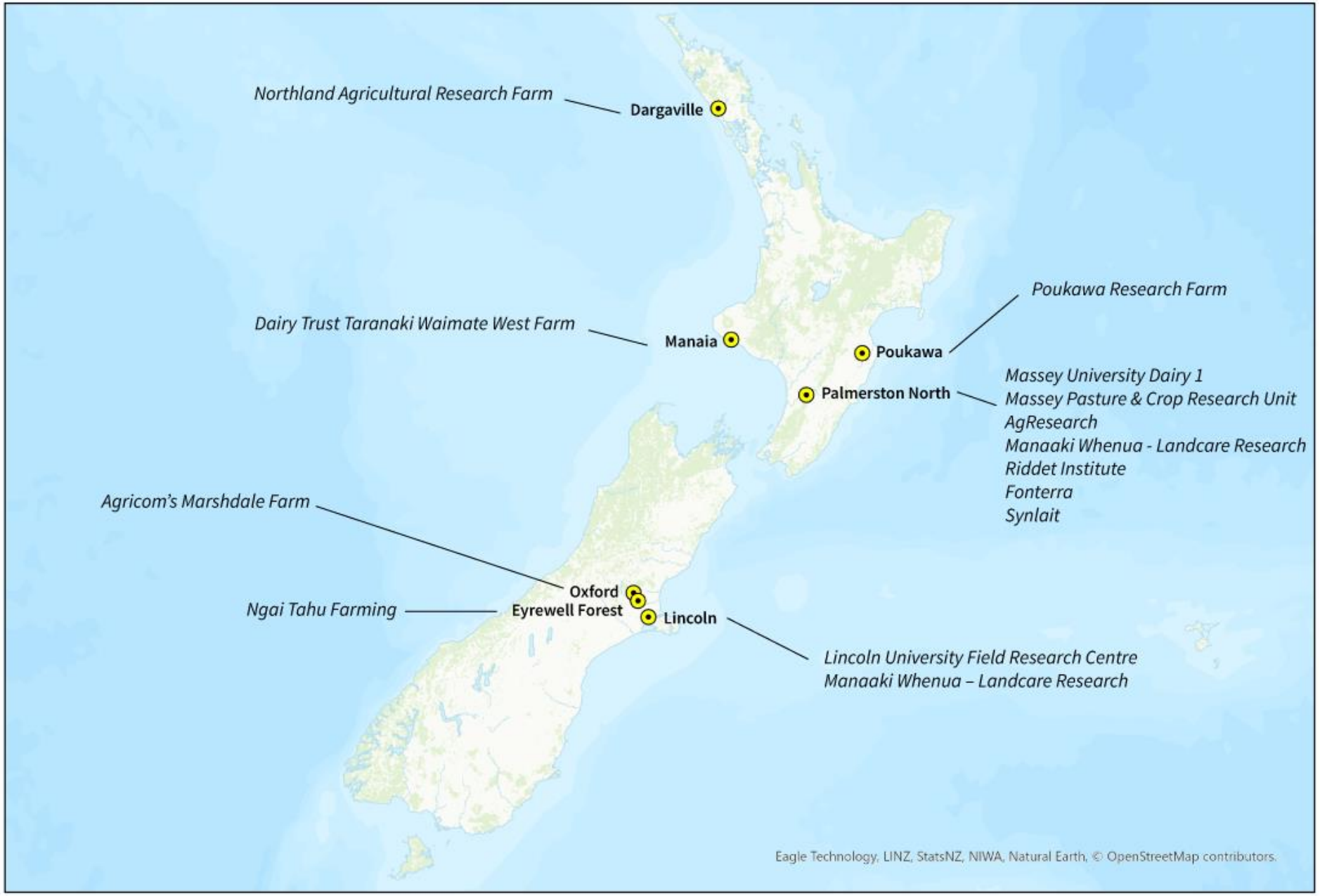
TOW AND FERT
BY METALFORM

Ballance
agri-nutrients

Quorum Sense

Northland Dairy
NDDT
Development Trust

ravensdown


Northland Agricultural Research Farm
Dargaville
Dairy Trust Taranaki Waimate West Farm
Manaia
Poukawa Research Farm
Poukawa
Palmerston North
Massey University Dairy 1
Massey Pasture & Crop Research Unit
AgResearch
Manaaki Whenua - Landcare Research
Riddet Institute
Fonterra
Synlait
Agricom's Marshdale Farm
Oxford
Ngai Tahu Farming
Eyrewell Forest
Lincoln
Lincoln University Field Research Centre
Manaaki Whenua – Landcare Research
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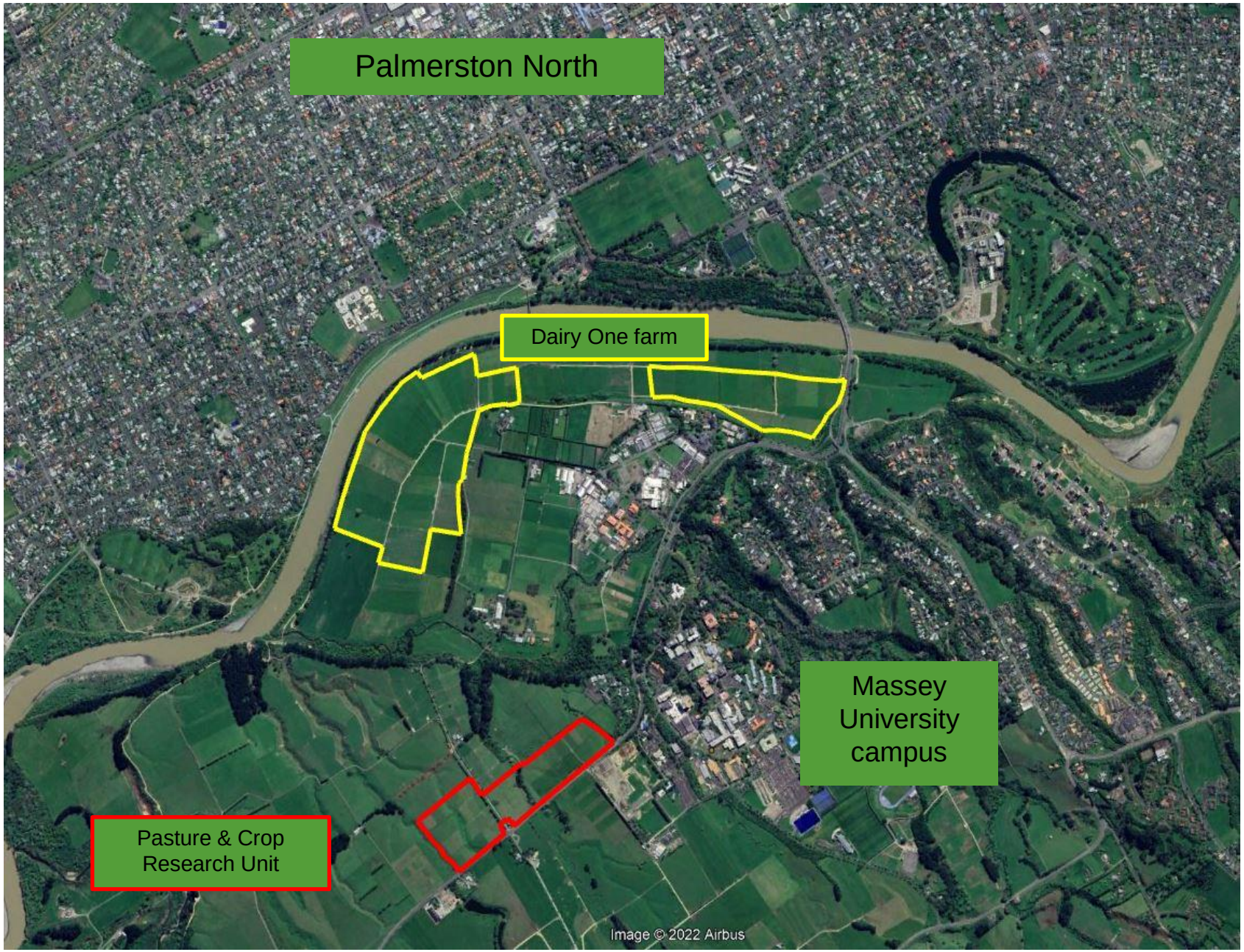
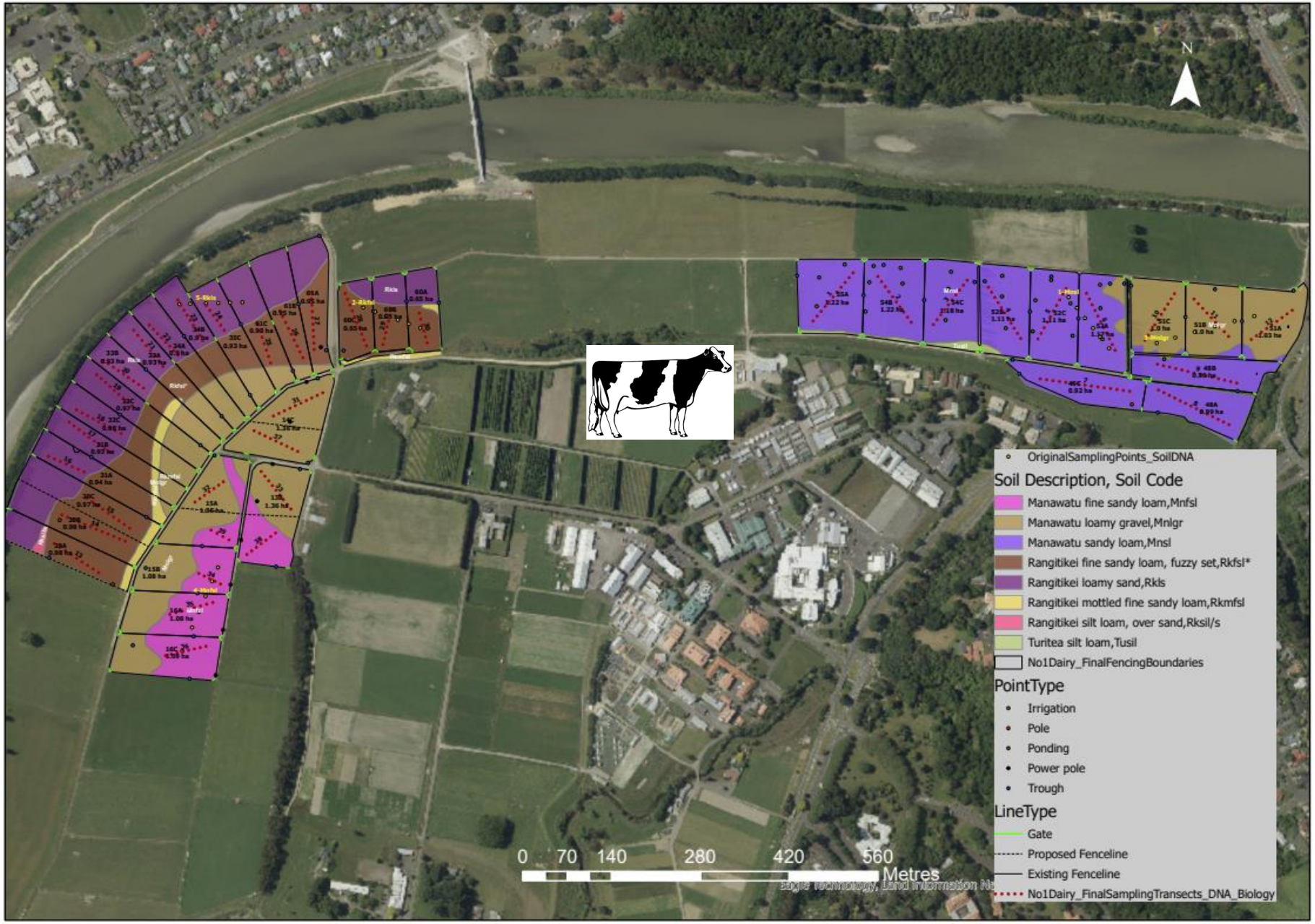

Palmerston North
Dairy One farm
Massey University campus
Pasture & Crop Research Unit
Image © 2022 Airbus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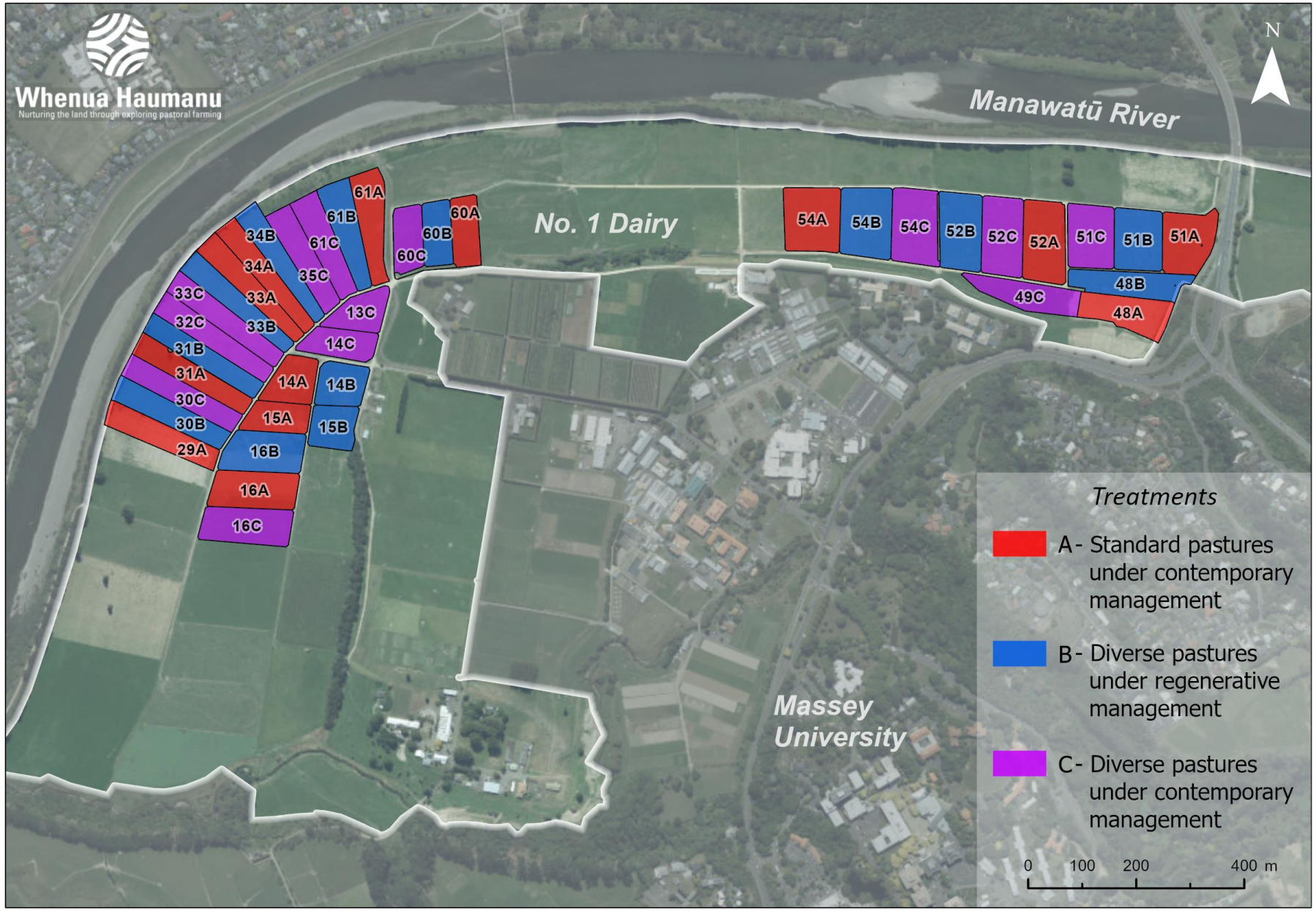
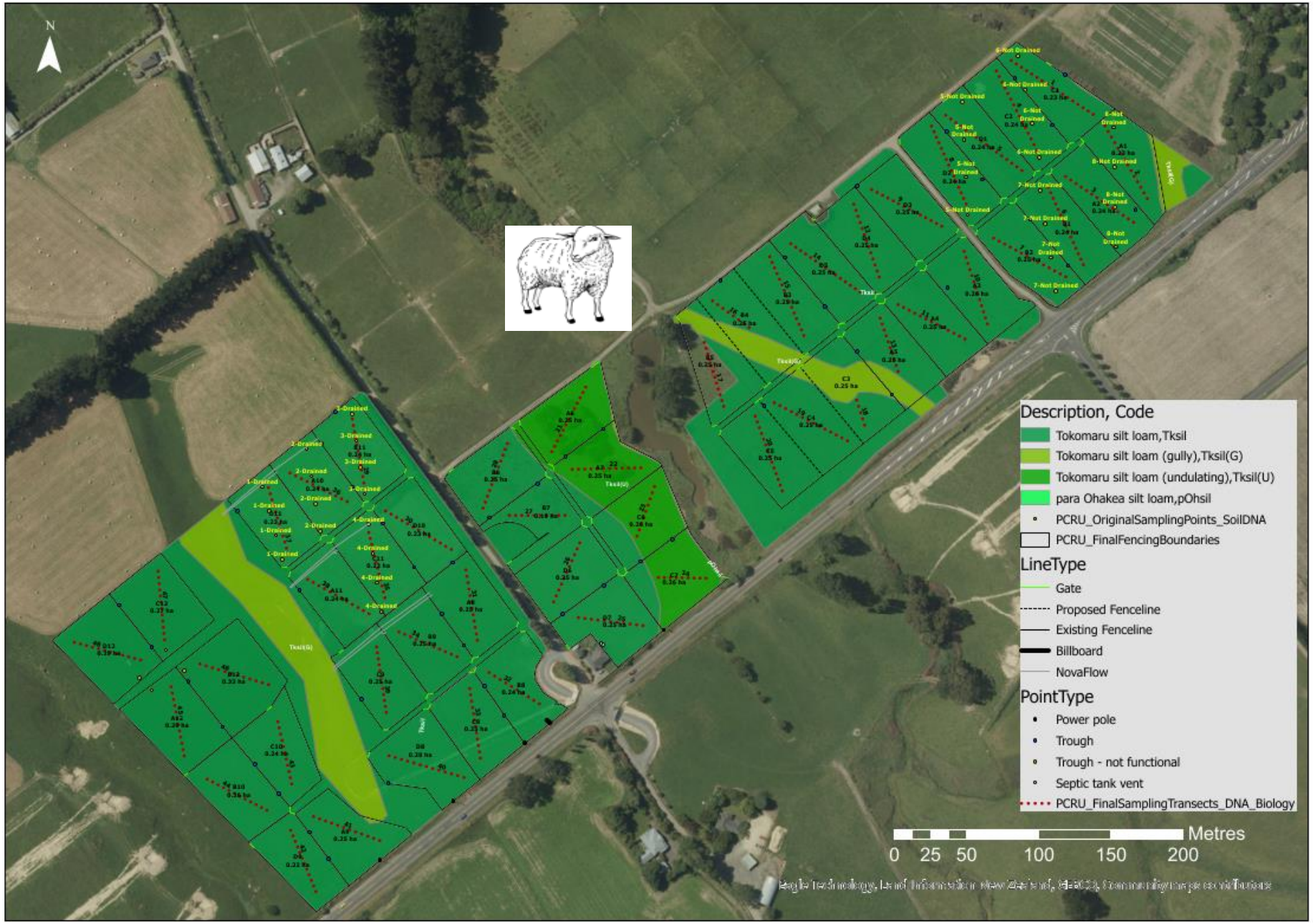
OriginalSamplingPoints_SoilDNA
Soil Description, Soil Code
Manawatu fine sandy loam,Mnfsl
Manawatu loamy gravel,Mnlgr
Manawatu sandy loam,Mnsl
Rangitikei fine sandy loam, fuzzy set,Rkfs!*
Rangitikei loamy sand,Rkls
Rangitikei mottled fine sandy loam,Rkmfsl
Rangitikei silt loam, over sand,Rksil/s
Turitea silt loam,Tusil
No1Dairy_FinalFencingBoundaries
PointType
Irrigation
Pole
Ponding
Power pole
Trough
LineType
Gate
Proposed Fenceline
Existing Fenceline
No1Dairy_FinalSamplingTransects_DNA_Biology
0 70 140 280 420 560
Metres


Whenua Haumanu
Nurturing the land through exploring pastoral farming
N
Manawatū River
No. 1 Dairy
Massey University
61A
61B
61C
60A
60B
60C
34B
34A
35C
33C
33A
33B
32C
31B
31A
30C
30B
29A
13C
14C
14A
14B
15A
15B
16B
16A
16C
54A
54B
54C
52B
52C
52A
51C
51B
51A
48B
49C
48A
Treatments
A- Standard pastures under contemporary management
B- Diverse pastures under regenerative management
C- Diverse pastures under contemporary management
0
100
200
400 m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Description, Code
Tokomaru silt loam,Tksil
Tokomaru silt loam (gully),Tksil(G)
Tokomaru silt loam (undulating),Tksil(U)
para Ohakea silt loam,pOhsil
PCRU_OriginalSamplingPoints_SoilDNA
PCRU_FinalFencingBoundaries
LineType
Gate
Proposed Fenceline
Existing Fenceline
Billboard
NovaFlow
PointType
Power pole
Trough
Trough - not functional
Septic tank vent
PCRU_FinalSamplingTransects_DNA_Biology
Metres
0 25 50 100 150 200


Whenua Haumanu
Nurturing the land through exploring pastoral farming
N
Green Shed
Massey University
PCRU
Tennent Dr
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
B11
B12
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
Treatments
A - Standard pastures under contemporary management
B - Standard pastures under regenerative management
C - Diverse pastures under contemporary management
D - Diverse pastures under regenerative management
0 37.5 75 150 m

Treatments

Regenerative management

- Longer grazing intervals, higher post-grazing residuals, low to no mineral fertiliser and chemical use
- Mineral nitrogen input is <¼ of contemporary management, plus commonly used regenerative ameliorants (fish hydrolysate, seaweed)

Contemporary management

- Following Beef+Lamb NZ guidelines

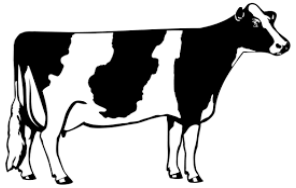
Sheep farmlet (3 ha/treatment)	Stocking rate/ha
A: Standard pastures, contemporary management	15 - 14
B: Standard pastures, regenerative management	15 - 12
C: Diverse pasture, contemporary management	15 - 13
D: Diverse pasture, regenerative management	15 - 12

Hyper-diverse pasture, 19 different legume, grasses and herbs

- diploid and tetraploid hybrid ryegrass, meadow fescue, cocksfoot, timothy, white clover (small and medium leaved), red clover, balansa clover, Persian clover, arrowleaf clover, subterranean clover, strawberry clover, chicory, plantain, bird's-foot trefoil, sanfoin, sheep's burnett, vetch

Standard pasture

- diploid and tetraploid perennial ryegrass with white and red clover



Treatments

Regenerative management

- Longer grazing intervals, higher post-grazing residuals, low to no mineral fertiliser and chemical use
- Mineral nitrogen input is <¼ of contemporary management, plus commonly used regenerative ameliorants (fish hydrolysate, seaweed)

Contemporary management

- Following DairyNZ guidelines

Dairy farmlet (12.5ha/treatment)	Stocking rate/ha
A: Standard pastures, contemporary management	2.5
B: Diverse pasture, regenerative management	2.5 - 2
C: Diverse pasture, contemporary management	2.5 - 2

Hyper-diverse pasture, 18 different legume, grasses and herbs

- diploid and tetraploid perennial ryegrass, tall fescue, meadow fescue, cocksfoot, timothy, phalaris, prairie grass, white clover (large and medium leaved), red clover, balansa clover, Persian clover, crimson clover, chicory, plantain, vetch, lucerne

Standard pasture

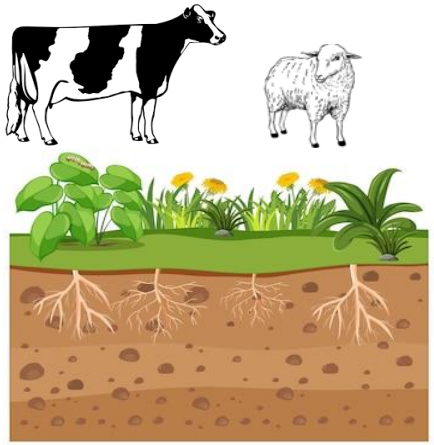
- diploid and tetraploid perennial ryegrass with white and red clover

Comprehensive research measures: below, on and above the ground

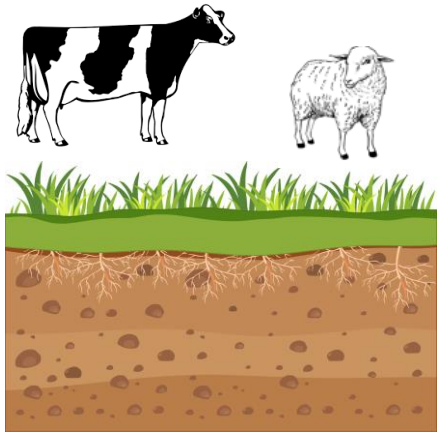
Engagement & extension
- Farmers, industry, iwi & scientists
- Demonstration farmlet/s
- Science/industry presentation/publications

Dairy & sheep production
- Liveweight & BCS
- Milk, liveweight & wool production
- N cycling & GHG emissions
- Meat and milk product quality

Dairy & sheep health & welfare
- Reproduction
- Health & welfare
- Rumen microbiome



Standard & diverse pastures under contemporary & regenerative management



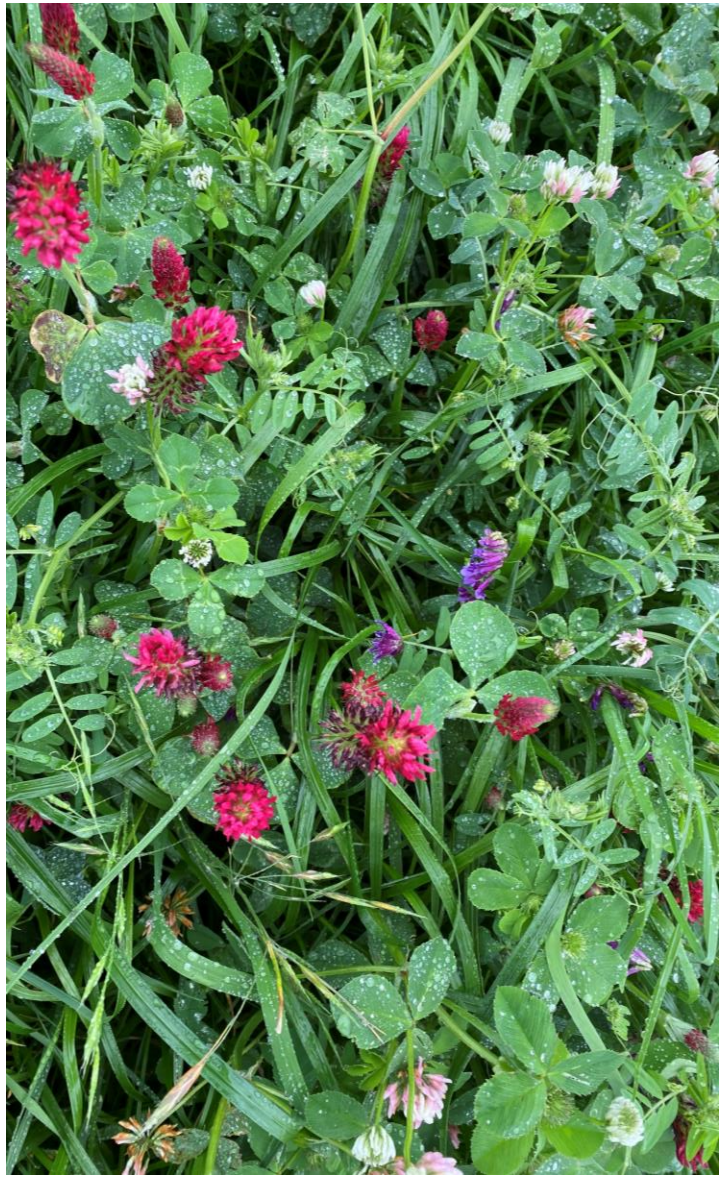
Pasture production
- Grazing residuals/rotations
- Mass/yields
- Growth rates
- Weeds/pests

Pasture quality & health
- Seasonal quality
- Seasonal composition
- NIR, FTIR, NDVI
- Root measurements

Soil carbon, fertility & biology
- Soil carbon
- Soil fertility
- Active microbiology
- Microbial DNA
- Microarthropods/mesofauna/earthworms
- Visual soil assessment

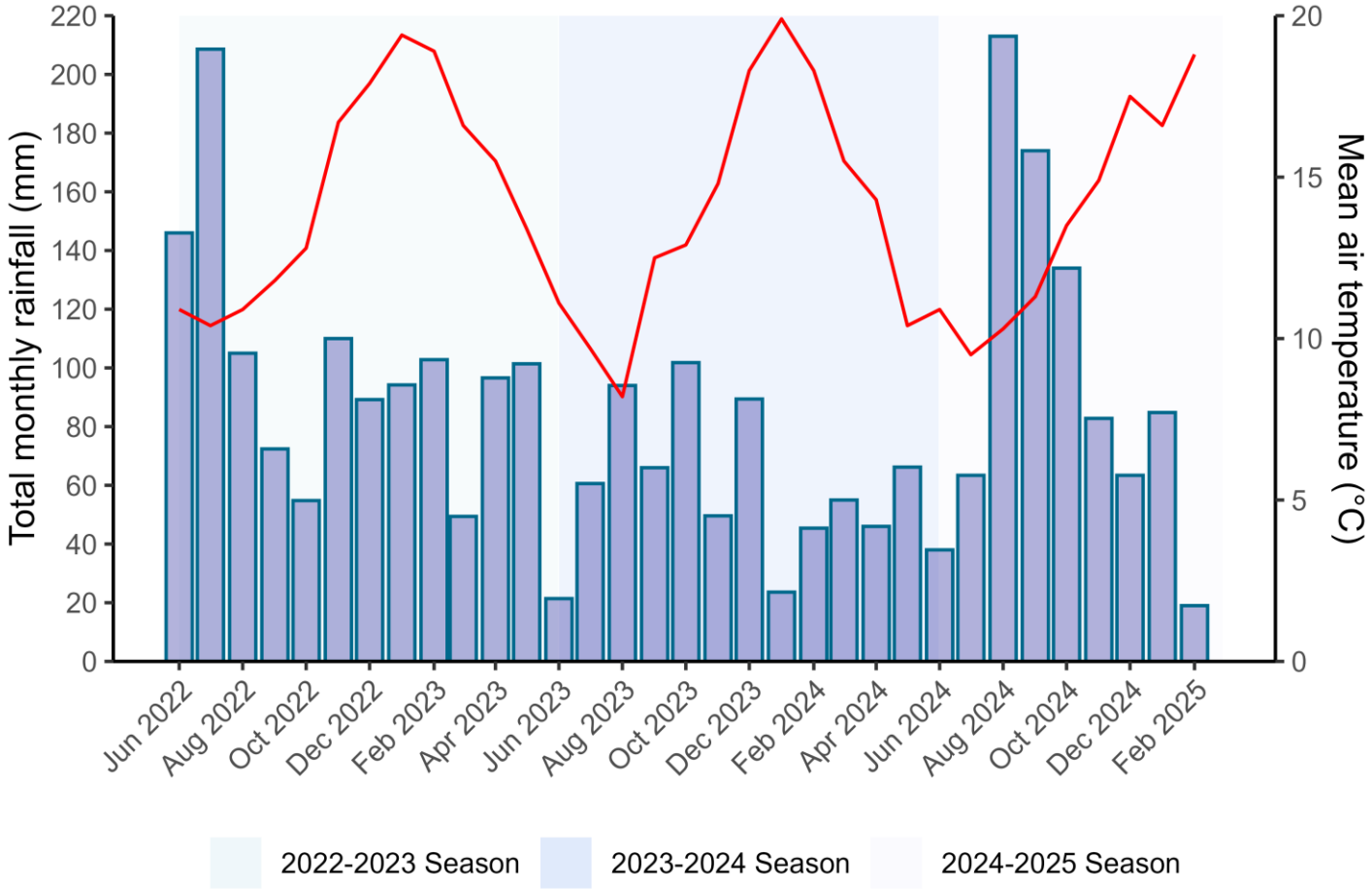
Climate & environment
- Weather/soil moisture
- Nutrient leaching
- Nitrous oxide emissions

Soil physical
- Bulk density
- Penetrability/compaction
- Aggregate stability
- Porosity
- Infiltration rates



WHENUA HAUMANU

Some key findings & learnings



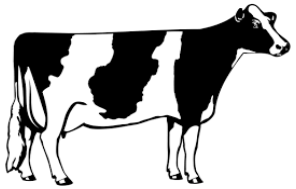
Total monthly rainfall (mm; blue bars) and mean air temperature (°C; red line)

Mild temperatures, few frosts throughout

Program started with driest autumn in 46 years, followed by wettest winter on record

Sheep farmlets: heavy soil , waterlogged and overgrazed in winter/early spring of Year 1

Dairy farmlets: free-draining soil, couldn't keep up to pasture growth in winter/spring of Year 1



Farmlets

New pastures yielded more than farm average, lots of (high quality) silage made in Year 1

Diverse pastures slower in cooler months and faster in warmer months, appeared to outyield standard pastures in Years 1 and 2, but some of this was an artefact of measurement (e.g. seedheads)

Similar milk production between treatments

Different milk fatty acid profiles from diverse pastures

Similar pasture growth early in Year 3, but diverse pastures starting to yield more in dry summer

Wet winter in Year 1 resulted in overgrazing of pastures in winter/spring, sheep were set stocked, and we don't have good pasture growth data

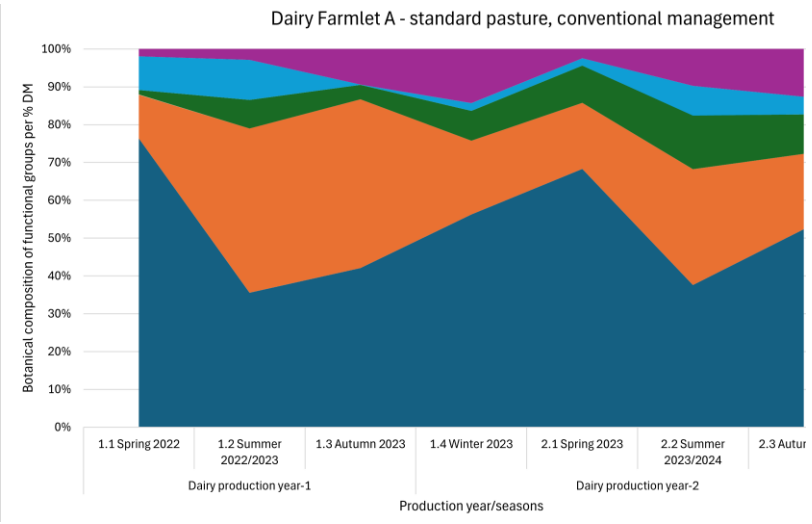
No effect of treatment on lamb survival

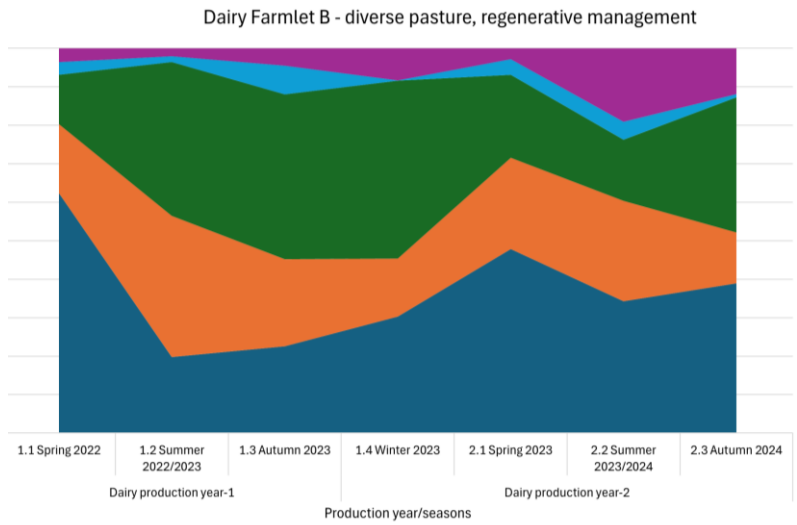
Faster lamb growth on diverse pastures

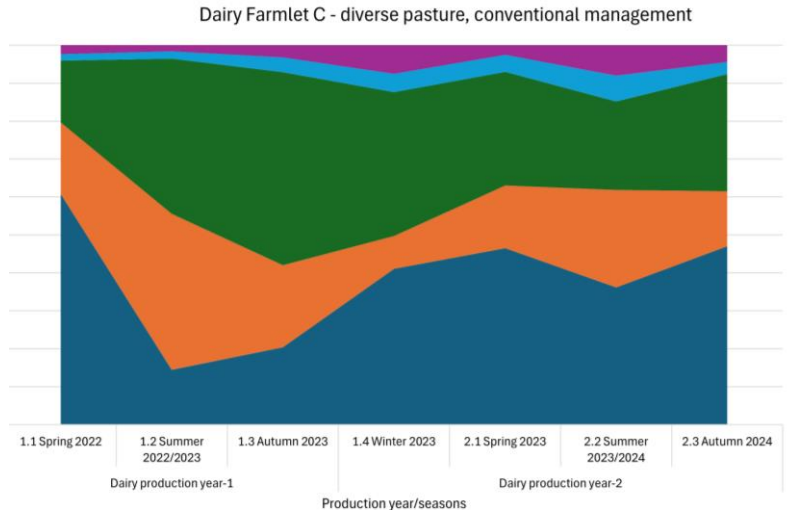
Surplus diverse pasture in summer (lambs sold); hay made in Year 1, deferred grazing used in Year 2. Cattle incorporated in Year 3

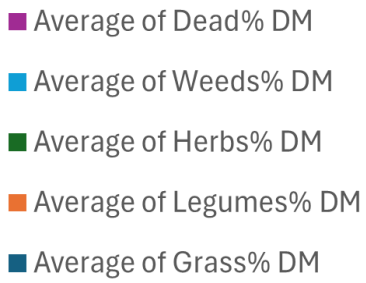
Similar pasture growth early in Year 3, but diverse pastures starting to yield more in dry summer

Dairy farmlets- botanical composition

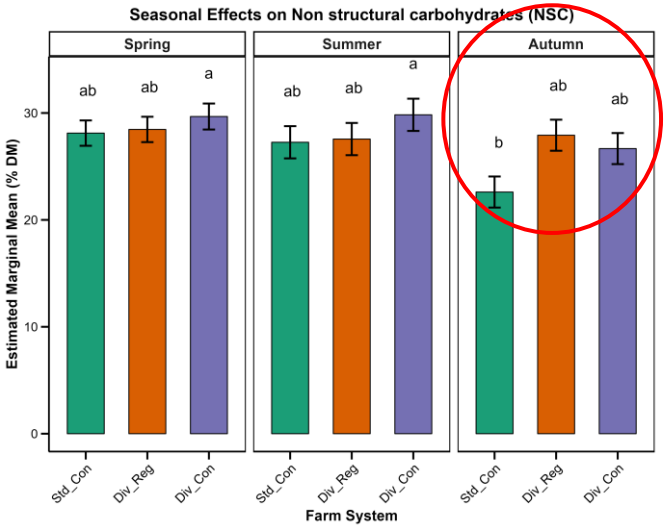


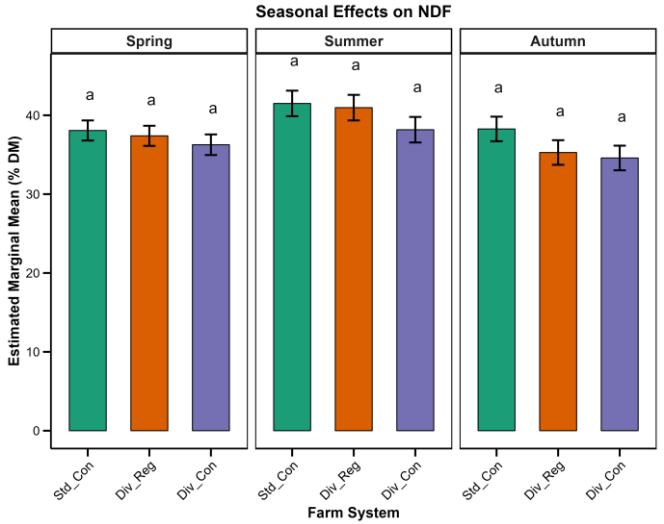


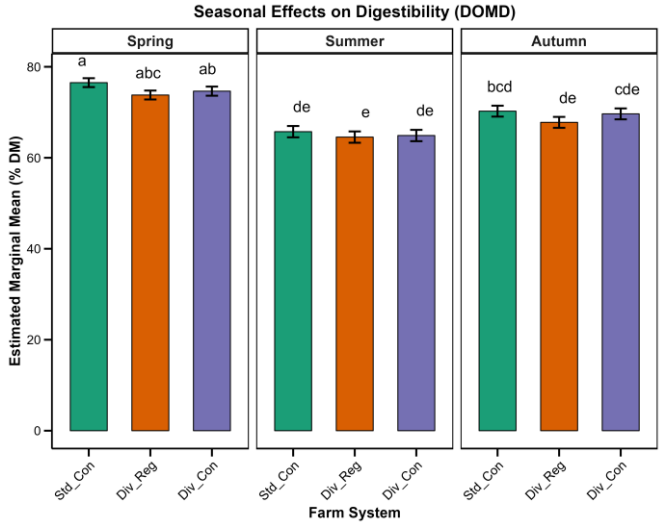


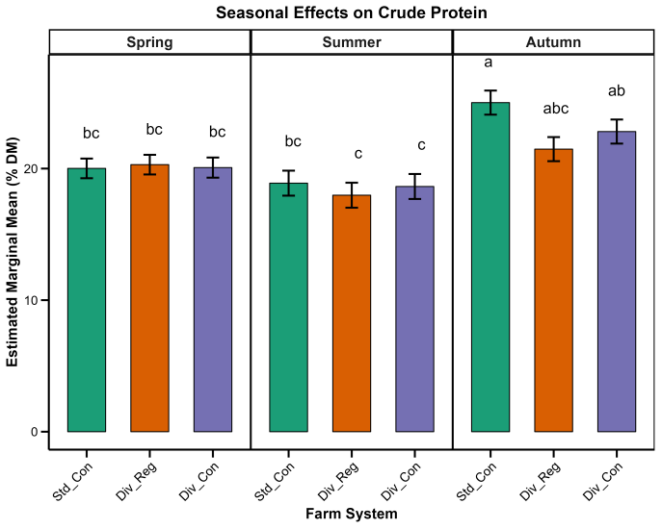


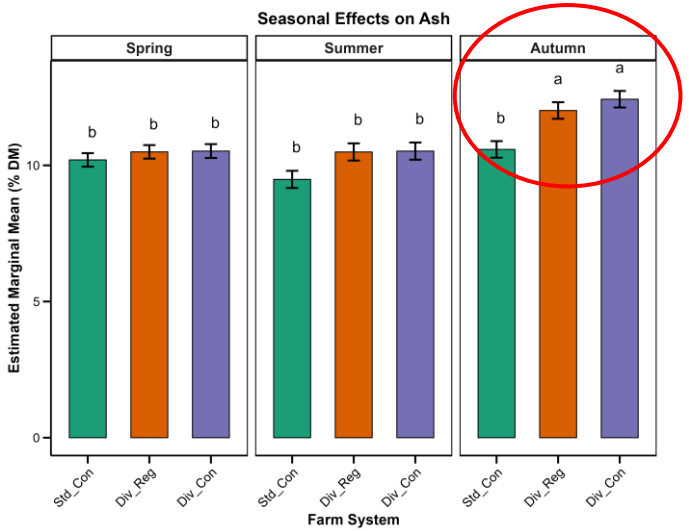
Dairy farmlets – nutritive values

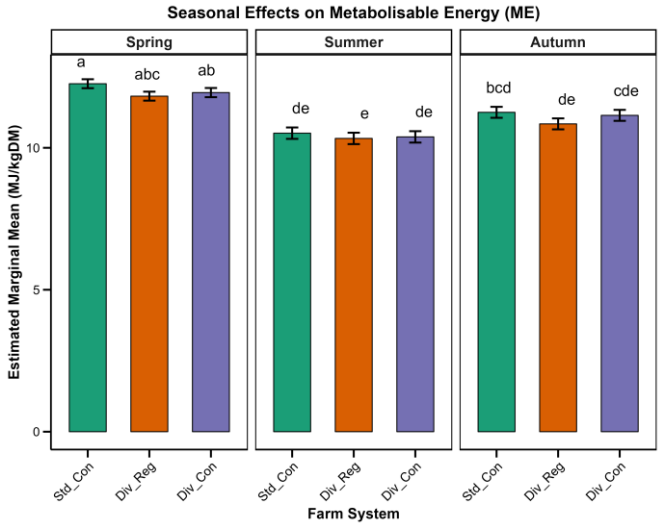




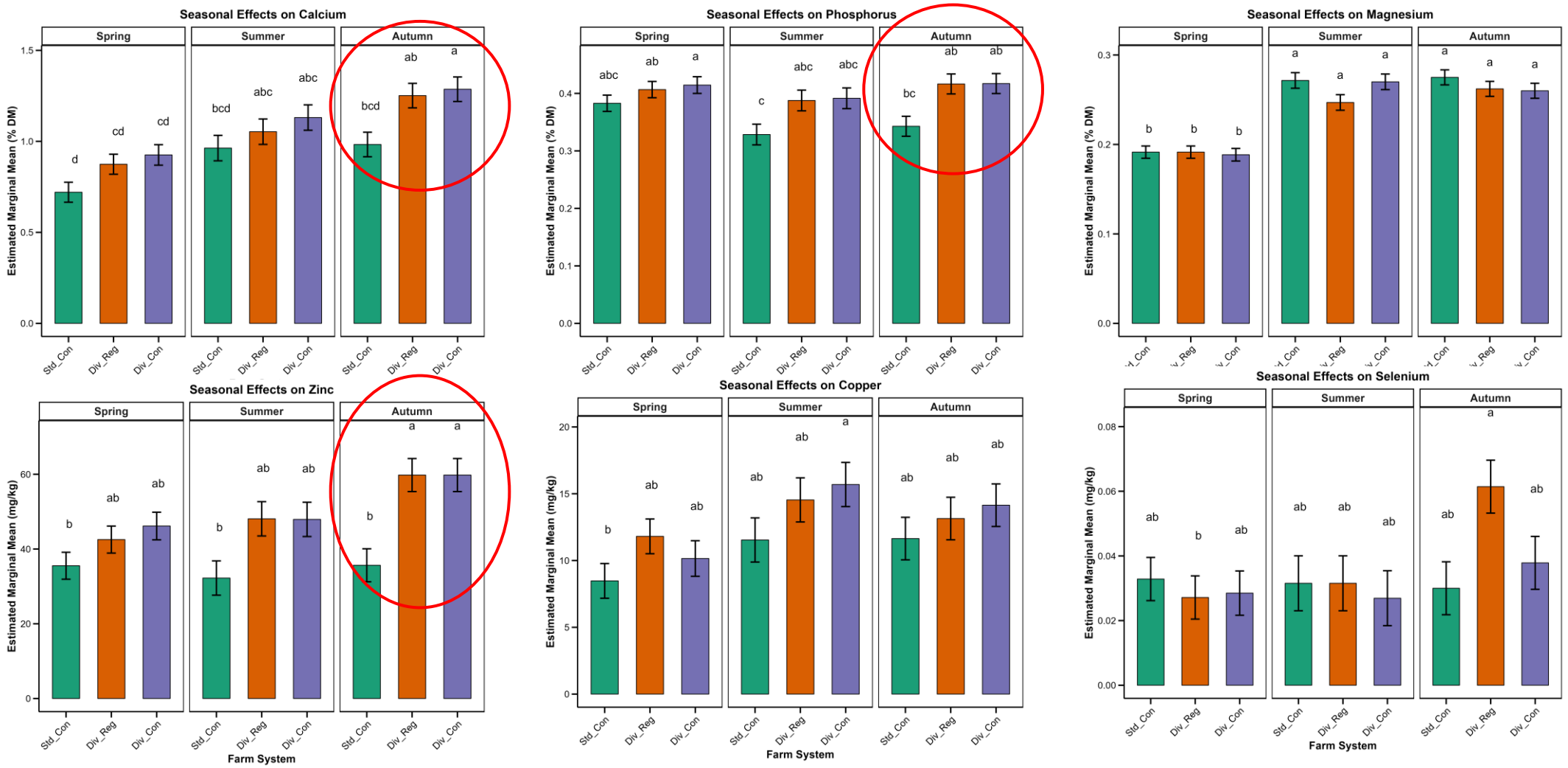




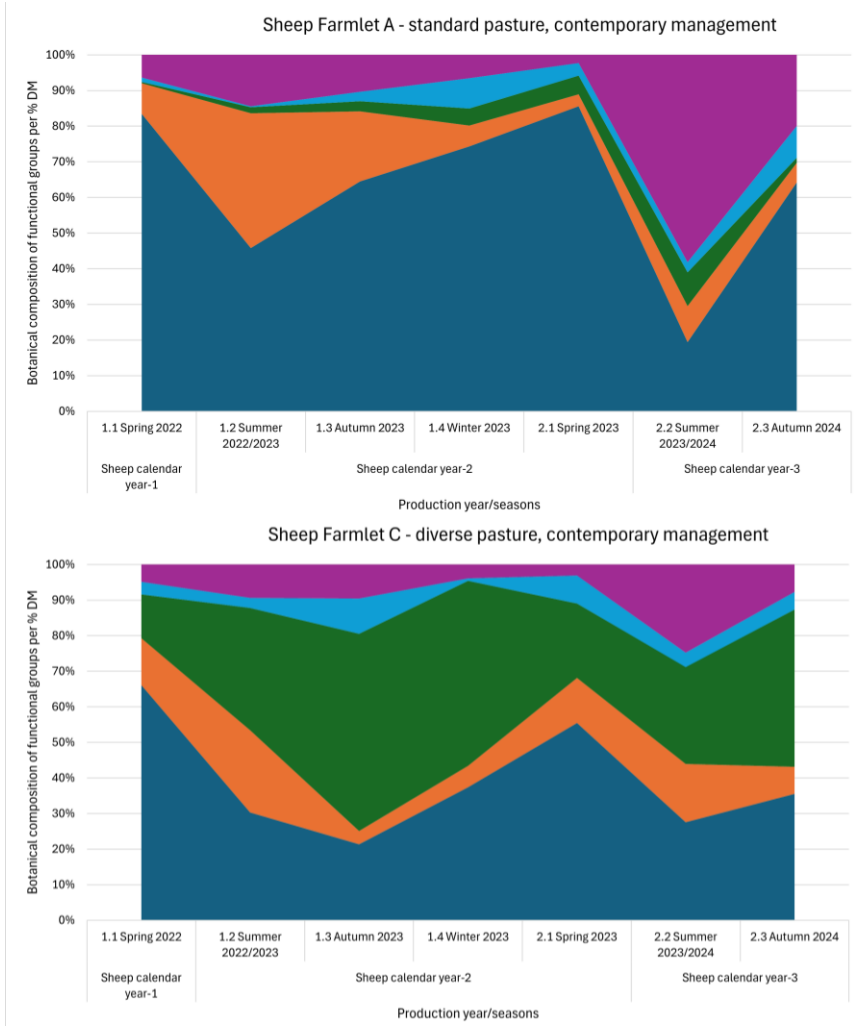


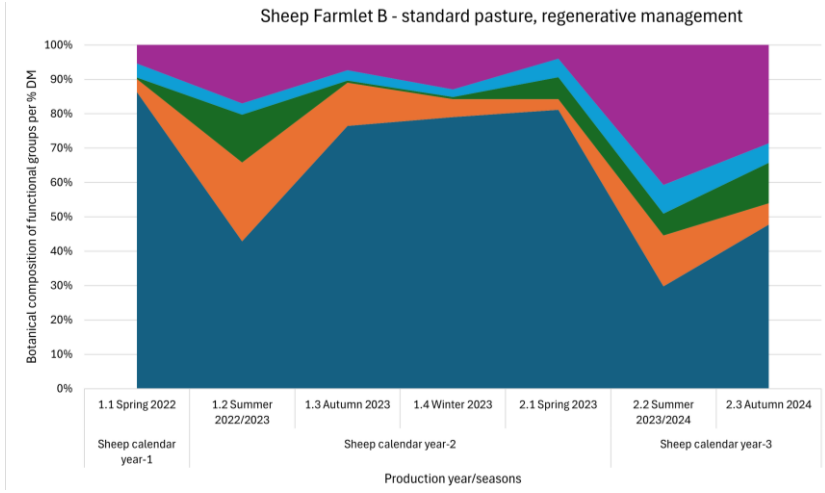


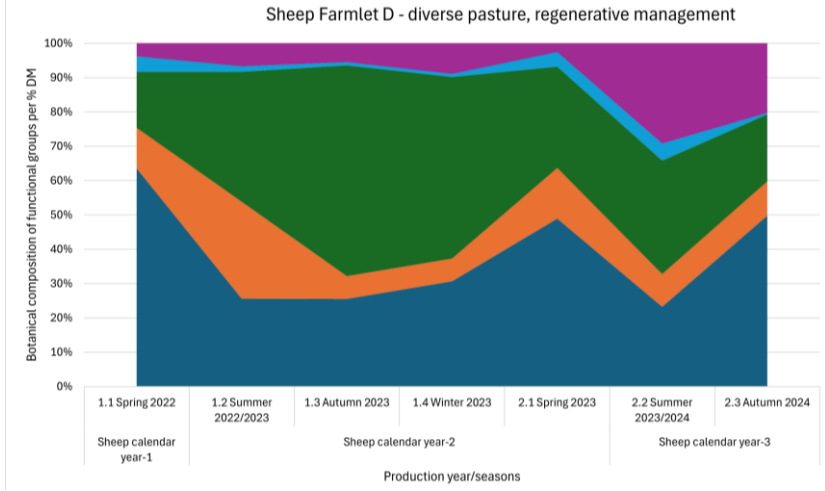
Dairy farmlets – mineral profile



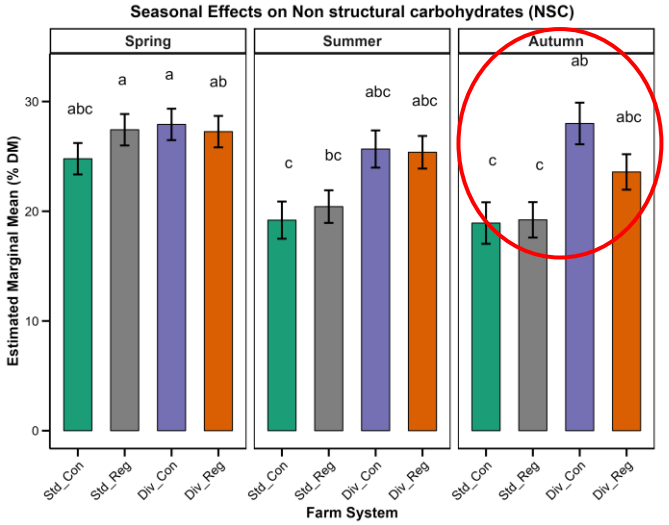
Sheep farmlets - botanical composition

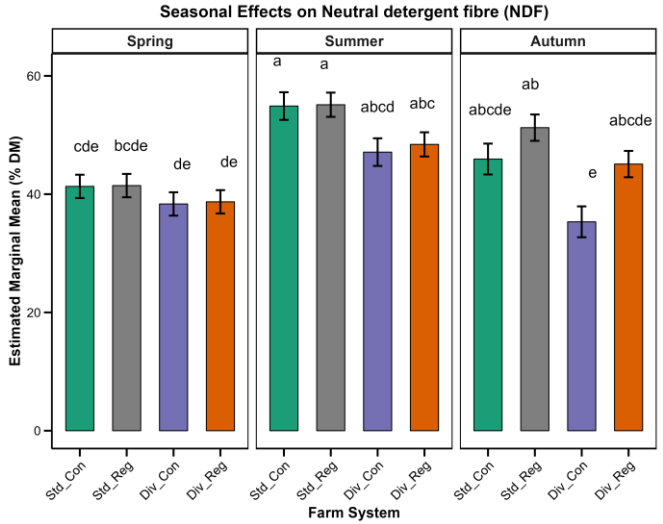


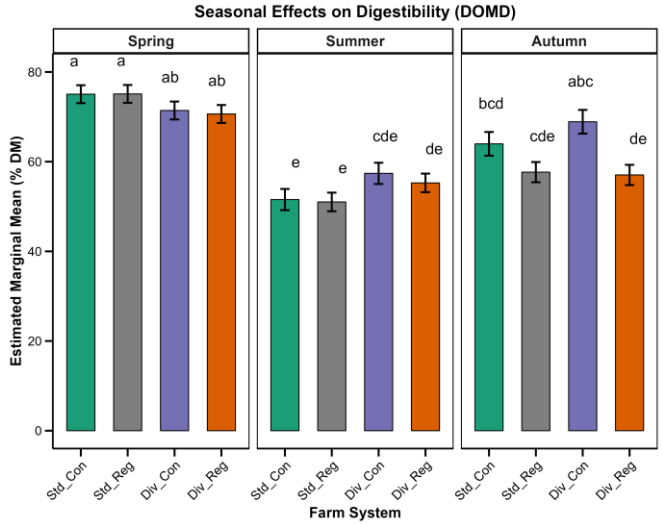


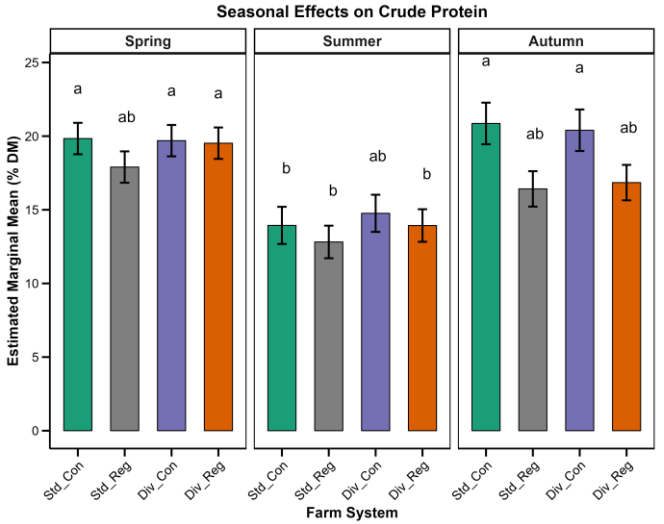


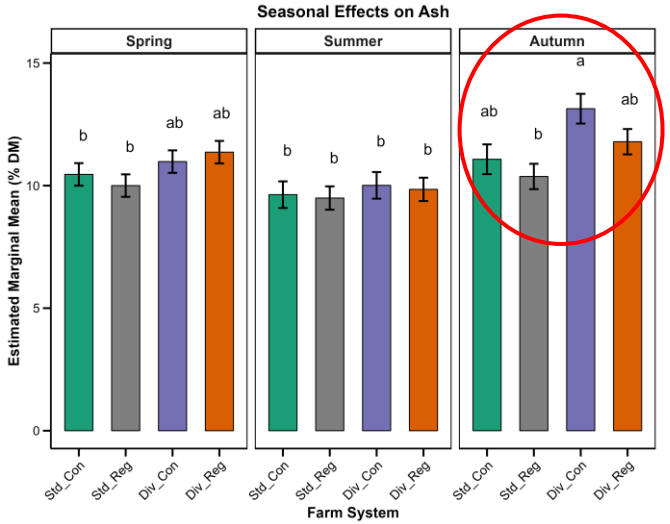
Sheep farmlets – nutritive values

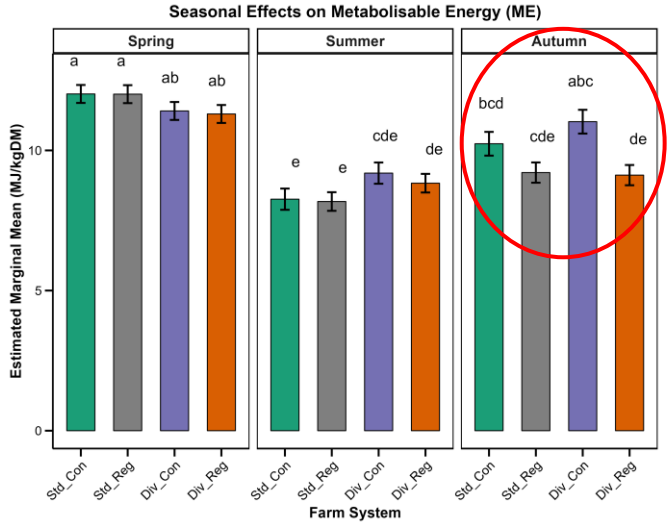




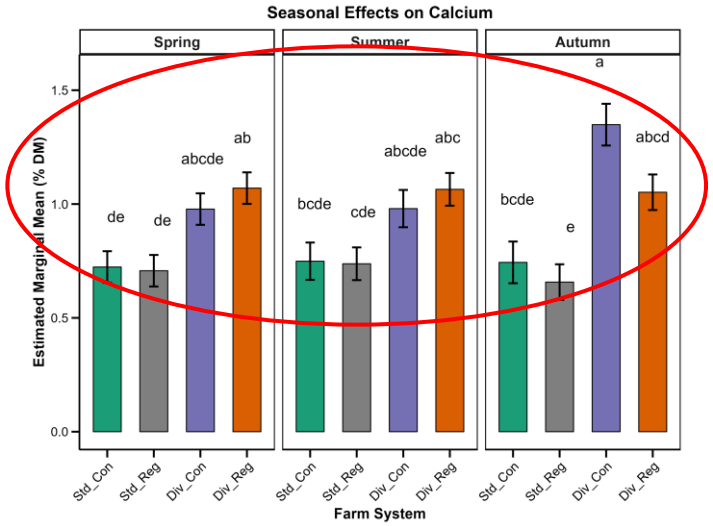


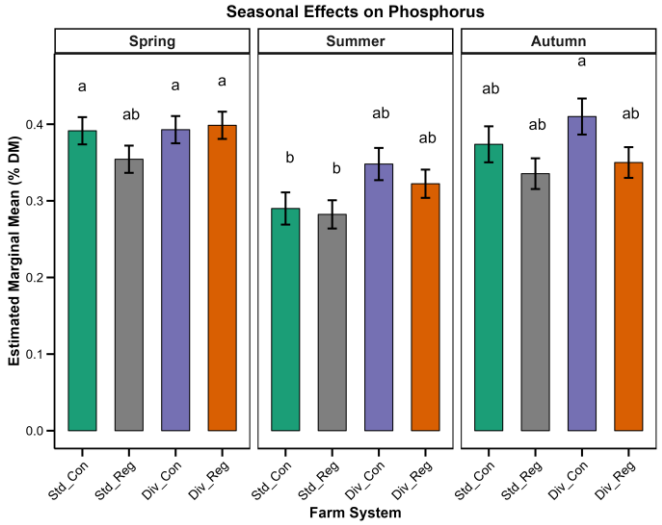


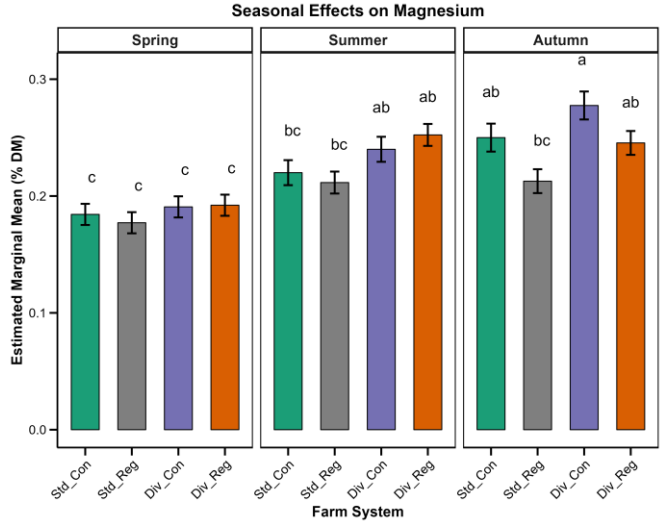


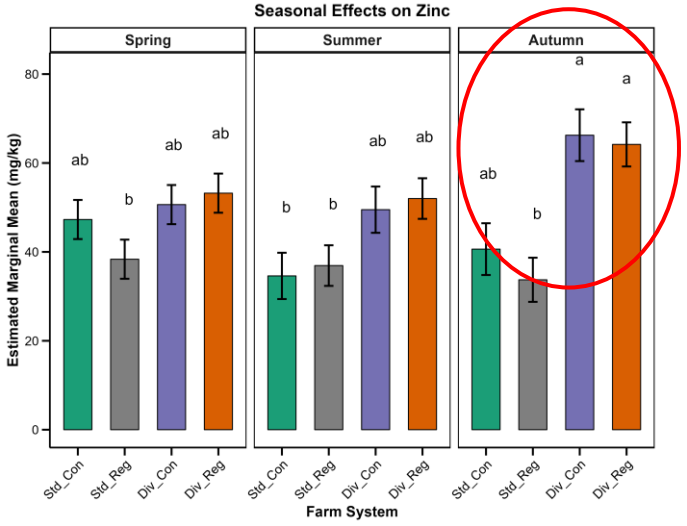


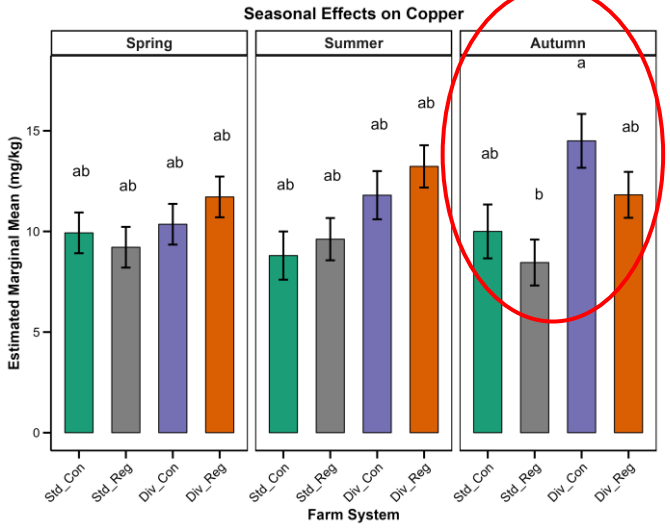
Sheep farmlets – mineral profile

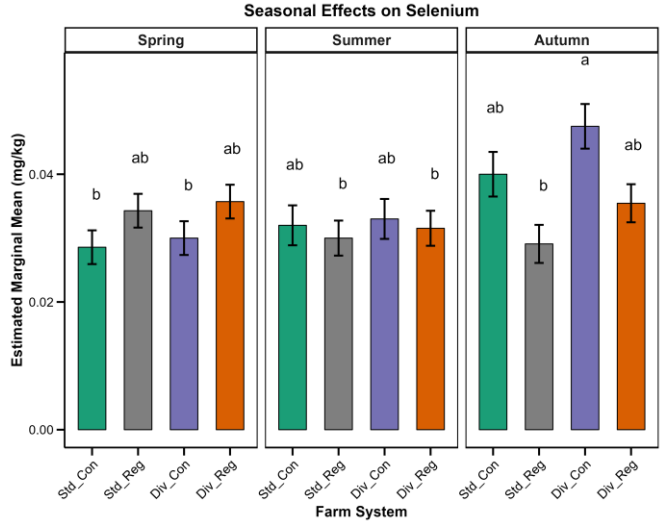












Summary of composition and nutritive value over 2 years

Most changes were associated with diversity rather than management

Herb component replaced grass in diverse pastures on a % basis

Trend for more dead material over time under regenerative grazing

Trend for lower weeds with greater diversity

The most significant changes in terms of nutritive value occurred during autumn

Dairy and sheep diverse pastures:

- Higher NSC
- More minerals (Ca, Zn, Cu, Mg*, Se*)

Pastures

Rising plate meter is able to be calibrated for diverse pastures (R^2 ~0.7)

About 10 different sown plants still showing in diverse pastures, but dominated by 3-5 at any one time

- Ryegrass
- White clover
- Cocksfoot
- Red clover
- Plantain

These 5 also dominated in a cutting study under 4 heights and 3 rotations

Don’t focus on the number of species; rather, think about what functionality you want from pasture

More thoughts on pasture diversity (historical research)

Greatest diversity under mowing, this reduces with grazing, more reduction with higher stocking rates and with sheep than cattle

Diversity varies spatially (within paddocks) and temporarily (between seasons and years)

Yield plateaus after 4 to 8 species in the pasture, and animal performance plateaus after 3 to 4 species

Each species needs to have a high enough population to achieve a measurable impact, and also needs a ‘time to shine’ - if they don’t get a chance to grow to their potential, or to fill their niche, then they’re unlikely to contribute much or persist

Diverse pastures are likely to require different managements

The Whenua Haumanu team

Whenua Haumanu

https://www.massey.ac.nz/whenua-haumanu/