Welcome to the Soil News

November 2025
Issue 4 -Vol 73

ISSN 1178-8968 (Online)

In this issue…

Your contributions are required - New Zealand Soil News is your newsletter

John Drewry
Bioeconomy Science Institute
(Manaaki Whenua - Landcare Research)
Private Bag 11052 Manawatu Mail Centre
Palmerston North 4442
email: drewryj@landcareresearch.co.nz

Have you liked us on Facebook?
The NZSSS has a Facebook page and Twitter handle (@NZ_Soil_Soc). If you are already a user, please follow us. You can also keep an eye out for new NZSSS posts by checking the feed from our website

Officers of the NZSSS December 2024-2026

President: Pierre Roudier (Bioeconomy Science Institute - Manaaki Whenua - Landcare Research)
Vice President: Diana Selbie (Bioeconomy Science Institute - AgResearch)
Past President: Sam Carrick (Bioeconomy Science Institute - Manaaki Whenua - Landcare Research)
Secretary: Wei Hu (Bioeconomy Science Institute - Plant & Food Research)
Treasurer: Natalie Bartlett (Bioeconomy Science Institute - AgResearch)

Council: Chris Anderson (Massey University); Kirstin Deuss (Bioeconomy Science Institute - Manaaki Whenua - Landcare Research; Early Career Researcher); Brendon Malcolm (Bioeconomy Science Institute - Plant & Food Research; Awards); Tanya O'Neill (Waikato University); Dori Torres-Rojas (Massey University); Haydon Jones (Waikato Regional Council; Policy); Jim Moir (Lincoln University); Fiona Curran-Cournane (Ministry for the Environment)

From the Editor

Welcome to this issue of Soil News.

We welcome Jen Owens from the Bioeconomy Science Institute - Scion soil team, and Vitor de Jesus Martins Bianchini who is a post-doc at University of Waikato, as two new correspondents for ‘News from the regions’. Many thanks to Simeon Smaill and Louis Schipper for their help in the past.

We have an article on the ‘Global Soil Macrofauna Bioturbation Survey’ project that measures soil organic matter associated with soil macrofauna.

With assistance from Jen Owens and David Siqueira of the Bioeconomy Science Institute - Scion, the team is looking for collaborators in New Zealand who are interested in contributing to this global study. Further information is reported in the article, with the opportunity to get involved with this global project. A protocol is presented if you wish to help with some measurements.

Check out the article from NZSSS team to grow our professional social media presence on LinkedIn.

Upcoming conferences

- NZSSS 2026, Christchurch – first announcement, see details below
- Soils with Variable Charge Conference
- International Conference on Geomorphology
- 23rd World Congress of Soil Science

Our abstracts section includes recent papers, plus also a link to ‘The Journal of the Royal Society of New Zealand’ which has a special issue on ‘The National Science Challenge Experiment: legacy and lessons’.

The abstracts section also includes a link to the annual edition of Journal of New Zealand Grasslands, published this month. It includes an article from their president, Chris Smith, who reflects on research during his career including production- and environmental-based research. The journal includes a range of soil-based research articles.

NZSSS Conference 2026

Save the date!

New Zealand Society of Soil Science Conference 2026 will be in Christchurch

Venue: TBC

Conference: Monday 30th November to Thursday 3rd December

Soil Judging Competition: Friday 27th to Sunday 29th November

NZSSS on LinkedIn

The New Zealand Society of Soil Science (NZSSS) wants to grow its professional social media presence on LinkedIn, to increase wider engagement and conversation around soils. This will be a platform for our members to connect with the wider soil and land community.

To support this goal, we're inviting NZSSS members to contribute their own posts! You are invited to share research highlights, events, job vacancies, outreach activities, or any other soil-related insights that will help make our page more engaging and showcase the diversity of work happening across the sector. Your posts will reach an engaged and growing audience, helping bring soils into wider conversation and awareness.

All member posts will appear with the tag:
📝 This is a NZSSS Member Post

Member Post Guidelines:

To keep our page professional and aligned with NZSSS objectives, please ensure your post:

- Is submitted by a current NZSSS member,
- Includes complete, ready-to-post text,
- Includes a relevant and engaging image,
- Fits within the character limit on LinkedIn (currently 3,000 characters, including spaces, emojis, and line breaks), allowing for the 30-character Member Post tag,
- Relates to soil science or the wider land management sector,
- Supports the objectives of the Society (see https://www.soilscience.org.nz/about),
- Is accurate, properly referenced where needed, and respectful in tone,
- Is not for political or commercial promotion,
- Is original or correctly credited (reposts allowed if adapted for NZSSS audience).

All posts are subject to approval by the NZSSS social media team prior to posting.

Examples of suitable posts:

- Soil observations, management experiences, local case studies,

- Job opportunities in soil and land science,
- Summaries of recent publications (written in accessible, non-technical language),
- Announcements for upcoming conferences, workshops, or training events,
- Educational videos, outreach activities, or resources related to soils,
- Awards, honours, or recognition of members' achievements,
- Community projects, citizen science initiatives, or volunteer activities,
- Conversation starters, e.g., ideas, questions, or discussion prompts about soils,
- Educational content, guides, or tips for understanding soil science.

Members can contact our current page manager, Kirstin Deuss (deussk@landcareresearch.co.nz) if interested in sharing content through the NZSSS LinkedIn page.

Global Soil Macrofauna Bioturbation Survey

Two scientists from Scion, Jen Owens and David Siqueira have been helping some international scientists find collaborators in New Zealand for a global bioturbation project that measures soil organic matter associated with soil macrofauna.

Further information is below, and the opportunity to get involved with this global project. A protocol is detailed further below if you wish to help with some measurements.

Overview

Soil bioturbation by macrofauna–such as earthworms, ants, and termites – plays a vital role in shaping soil structure, enhancing nutrient cycling, and supporting ecosystem health. These animals create visible surface structures that can serve as indicators of biological activity and soil function. However, standardized data on the extent of such activity across different land-use types and ecosystems are lacking.

The **Global Soil Macrofauna Bioturbation Survey** provides a unified protocol to measure and compare soil surface structures created by animals in both natural and anthropogenic habitats worldwide. By quantifying the dry mass and organic matter content of these structures, along with key environmental data, this project aims to assess how land use influences soil animal activity and contribute to a global understanding of soil biodiversity and function.

We are looking for collaborators who are interested in contributing to the study. If you're interested in participating, or would like to learn more, please reach out to petr.hedenec@umt.edu.my

Global Soil Macrofauna Bioturbation Survey – Join us!

We are launching a **global collaborative project** to measure how much soil is processed by animals in different natural and anthropogenic environments worldwide.




What you'll do:
Choose **two sites** in your region:
1 **Natural** (forest, grassland, wetland, etc.)
2 **Anthropogenic** (cropland, pasture, plantation, urban green space, etc.)
A) At each site, select 3 plots (1 m² each), spaced 50–100 m apart.
B) Identify and collect all visible animal-made soil structures (earthworm casts, anthills, cicada chimneys, wasp heaps, etc.) from the plot surface. **Make one composite sample per animal structure per plot.**
C) Dry and weigh collected samples. Record **weight per structure (e.g. anthill, wasp heap, earthworms casts, wasp heap) type per plot**.
D) Repeat the measurements three times at **1-week intervals** to capture temporal changes.
E) Take weighted dry samples from surface soil structures for loss-on-ignition (LOI) to estimate SOM content in structures.
F) Record vegetation cover (% of trees, shrubs, bare soil etc.) based on linear transect method.

We provide:
1. **Detailed protocol & data sheet**
2. **Acknowledgment in resulting publications**
3. **Opportunity to co-author if you contribute data from ≥2 sites**

Measuring Large Soil Structures (e.g., Termite Mounds or Big Anthills)
For bigger features that can't be collected whole:
1.Measure the mound dimensions
1. If mound is roughly conical:
   Volume ≈ (1/3) × π × (base radius²) × height
2. If mound is dome-shaped (hemisphere):
   Volume ≈ (2/3) × π × (radius³)
3. For irregular shapes: divide into simple shapes (cones, cylinders, spheres) and sum their volumes.

2.Collect a sample for bulk density (BD)
1. Take a representative piece of the mound, dry at 105 °C, weigh, and divide by its volume.

3.Calculate total mass
1. *Mass = Volume × Bulk Density*
2. Convert to kg or g as needed.

4.Record mound type and age (if known) to help with data interpretation.

Project duration: [2025-2026]
Interested? DM me or email:
petr.hedenec@umt.edu.my
Let's see how soil animals reshape the Earth — together!





UMT | IBTPL INSTITUT BIODIVERSITI TROPIKA DAN PEMBANGUNAN LESTARI | UMT

No sending samples abroad. Send us only weights of the structures per animal per site and corresponding LOI data

Global Soil Macrofauna Bioturbation Survey — Protocol

Goal: Quantify the dry mass (g) of animal-made-soil surface structures per 1 m² plot, compare natural vs. anthropogenic sites, and estimate SOM content in structures using Loss-on-Ignition (LOI).

1. Site & Plot Selection

Choose at least two sampling sites located ≥ 1 km apart, ensuring that one site represents a natural habitat (forests, grassland, wetland etc.) and the other an anthropogenic site (cropland, urban park). At each site, prepare three 1 m² plots, positioned 50–100 m apart. For each plot, record the GPS coordinates, write a brief habitat description, and determine the percentage of vegetation cover (trees, shrubs, herbs, and bare ground) using a 10 m linear transect. Record recent weather conditions and note whether rainfall occurred in the past 24 hours (yes/no). Avoid sampling immediately after heavy rain whenever possible.

2. Plot-Level Sampling — Surface Structures

Place the 1 m² quadrat on the designated plot. Identify all visible animal-made soil structures (e.g., earthworm casts, small anthills, wasp heaps, cicada chimneys, molehills, beetle pellets). Photograph both the entire plot and each structure type individually. Collect all material of each structure type within the quadrat, ensuring completeness. Prepare one composite sample bag for each structure type per plot (e.g., Plot A1 — “earthworm casts”, Plot A1 anthills, Plot A2 “earthworms casts”). Clearly label each sample and keep structure types separate—do not mix different types in the same bag.

Example of earthworms casts (left) small anthills (right).

3. Sampling Schedule

Conduct three sampling rounds per plot at 1-week intervals (Day 0, Day 7, Day 14). After each sampling event, completely clear the plot of all soil structures. In subsequent rounds, collect he newly produced structures that have appeared since the previous sampling.

4. Drying & Weighing

Keep all collected samples cool and dry until processing. Dry samples in an oven at 105 °C until constant weight is achieved (typically 24–48 h). Record the dry mass (g) using an analytical balance with 0.01 g precision if available. For Loss-on-Ignition (LOI) analysis, take a homogenized subsample (5–20 g) after drying for further processing.

6. Loss-on-Ignition (LOI) for SOM

Dry crucibles and subsamples at 105 °C, then record m_1 (mass of crucible + dried sample). Ignite the samples in a muffle furnace at 550 °C for 6 h, then cool in a desiccator. Record m_2 (mass of crucible + ignited residue). Calculate organic matter content (%) using the formula:

$$\text{OM } (\%) = \frac{(m_1 - m_2) - m_{\text{crucible}}}{(m_1 - m_{\text{crucible}})} \times 100$$

where m_1 and m_2 always have the crucible mass subtracted. Also perform LOI on adjacent bulk soil samples for comparison.

7. Bulk Density Sampling and Measurement.

Use a known-volume corer (e.g., 100 cm³) or a Kopecky cylinder to extract soil samples from the site next to designated plots. Collect three samples using the volume corer to obtain an average value from triplicates. Dry the samples at 105 °C until a constant weight is reached, then weigh and record the dry mass. Calculate bulk density (BD) using the formula:

$$\text{BD } (\text{g/cm}^3) = \frac{\text{Dry mass (g)}}{\text{Core volume (cm}^3)}$$

This BD value will be used to convert mound or structure volume into mass. From the remaining soil perform measurement of pH and LOI.

8. Measuring Large Mounds (Termites, Large Ant Hills)

Measure base diameter(s) and height.

For the large structure such as large anthill or termite nests which are impossible to collect as a such, use the following geometric formulas to estimate mound or structure volume:

- Cone:

$$V \approx \frac{1}{3} \times \pi \times r^2 \times \text{height}$$

- Hemisphere:

$$V \approx \frac{2}{3} \times \pi \times r^3$$

The Pi number π is 3.14 and r represents radius of the nest or hill. For irregular shapes, divide the structure into simple geometric shapes, calculate each volume separately, and sum the results. Multiply the total volume by the measured bulk density to estimate total dry mass (in g or kg).

Example of the different type of termite mound

9. Vegetation Cover

Establish a 10 m transect within each site where sampling plots are located, ensuring it represents the general habitat conditions. Place the transect tape firmly on the ground in a straight line. At regular intervals (e.g., every 0.5 or 1 m), record the ground cover category directly along tape using the following classes: trees, shrubs, herbs, grasses, moss, bare soil, and litter. Visually estimate the total percentage cover of each category across the transect and ensure that the combined cover values sum to approximately 100%. Record the dominant plant species for each vegetation layer (tree, shrub, herbaceous) to provide context for habitat structure.

10. Additional Site Data

For each site, record the following background information: country, latitude, and longitude (in decimal degrees); mean annual temperature (°C) and mean annual precipitation (mm) obtained from local weather station data or reliable online climate databases; habitat type (e.g., forest, grassland, cropland, wetland); and land use classification (natural vs. anthropogenic). This information will be used to characterize environmental conditions and compare results across sites.

Please send attached excel file with date to this email address:

petr.hedenec@umt.edu.my

Example Data Table

	Soil Structure (e.g. Ant hill, termite nest, wasp heap, earthworms casts, etc.)	Structure Weight kg	Structure LOI (%)	Local soil LOI (%)	Local soil pH	Local soil Bulk density (g cm3)	Habitat (Forest, Grassland, Cropland)	Land use (Anthropogenic vs Natural)	Country	Latitude	Longitude	Mean annual temperature (°C)	Mean annual precipitation (mm)	Dominant vegetation (e.g. Quercus robur, Poa annua etc.	Trees (%)	Shrubs (%)	Herbs (%)	Grasses (%)	Mosses (%)	Bare soil (%)	Litter (&)	Soil type	Sampling time
Sample1	Earthworm cast	0.25	12	8	5.8	1.1	Forest	Natural	China	26.36474	108.759	16.9	1200	Cyclobalanopsis, Itea, Lithocarpus, Machilus, Cinnamomum.	60	12	0	0	0	0	3	Cambisol	Jul-25
Sample2	Earthworm cast	0.4	10	9	5.8	1.3	Forest	Natural	China	26.36474	108.759	16.9	1200	Cyclobalanopsis, Itea, Lithocarpus, Machilus, Cinnamomum.	78	10	0	0	0	0	5	Cambisol	Jul-25
Sample3	Earthworm cast	0.2	25	13	5.8	1.1	Forest	Natural	China	26.36474	108.759	16.9	1200	Cyclobalanopsis, Itea, Lithocarpus, Machilus, Cinnamomum.	65	21	0	0	0	0	5	Cambisol	Jul-25
Sample4	Ant hill	0.9	13	8	6.2	1.2	Forest	Natural	China	26.36474	108.759	16.9	1200	Cyclobalanopsis, Itea, Lithocarpus, Machilus, Cinnamomum.	50	18	0	0	0	0	5	Cambisol	Jul-25
Sample5	Ant hill	0.88	14	9	6.2	1.1	Forest	Natural	China	26.36474	108.759	16.9	1200	Cyclobalanopsis, Itea, Lithocarpus, Machilus, Cinnamomum.	70	30	0	0	0	0	5	Cambisol	Jul-25
Sample6	Ant hill	0.78	19	11	6.2	1.3	Forest	Natural	China	26.36474	108.759	16.9	1200	Cyclobalanopsis, Itea, Lithocarpus, Machilus, Cinnamomum.	55	28	0	0	0	0	5	Cambisol	Jul-25

Response to book review: ‘Interpreting soil test results: What do all the numbers mean?’

This book was reviewed in the August 2025 issue of Soil News, from a New Zealand perspective.

The authors Brian Murphy and Pam Hazelton have prepared a response below and have requested it be placed in Soil News.

Response to:

Book review: New Zealand Soil Science News; Vol 73, Issue 3, August 2025.

‘Interpreting soil test results: What do all the numbers mean?’ Interpreting Soil Test Results: What Do All the Numbers Mean? Fourth Edition. By: Pam Hazelton, Brian Murphy. CSIRO Publishing. Paperback - May 2025 - AU $69.99. ISBN: 9781486319367 | 200 pages

https://www.publish.csiro.au/book/8190/ CSIRO Publishing in Australia have recently released the 4th edition of this book.

Response – Brian Murphy and Pam Hazelton

As authors we thank the kind review by the New Zealand soil scientists in the latest NZ Soil News (Dr John Drewry with some insights from Linda Hill). We would like to respond to some of the points raised by the reviewers.

- In relation to rating levels for values of soil cation exchange capacity (CEC) the reviewers state that Metson (1961) is indeed an old reference. However, the authors do provide a number of more recent references for rating values of CEC including McKenzie et al. (2004), Nicholas (2004) and DPI (1993). The Meston reference was maintained as it was the only one that included a full range of CEC values. A further table provided an estimate of the range of CEC values for individual soil components based on texture, clay minerals and soil organic matter.
- The reviewers query the inclusion of soil organic carbon values based on the Walkley Black soil test. This has largely been replaced in Australia by the LECO furnace determination, as the reviewers rightly point out as well as the modified Walkley Black test, the Heanes test (Heanes 1984). The Heanes test involves a more complete digestion of soil organic carbon in the soil. However, values from the Walkley Black test are maintained as historically there are many data sets that have values for soil organic carbon based on Walkley Black tests.

- The reviewers have drawn attention to the emphasis on the Colwell P test for rating soil phosphorus levels, and the omission of ratings based on the Olsen P test. There are several references that are used to derive the rating of critical values for soil P levels based on the Colwell P test. Importantly, the Colwell test has been shown to improve its reliability if the phosphorus buffering capacity of the soils, or the soil type is taken into account (several references see below; Bell a and b; Gourley 2007, 2019; Rogers 2021; Spears 2021; Weaver 2024).
- The reviewers point out that the use of silver thiourea for determining cation exchange capacity and exchangeable cations is an old methodology. It was included as the methodology was in the Australian Laboratory Handbook of Soil and water Chemical Methods (Rayment and Higginson 1992), at least some historical data will be based on this methodology.

Concluding note

Data and numbers are meaningless without placing meaning or interpretation on the numbers or values of soil tests and deriving statements about the implications for land and soil management or crop and pasture management. Hopefully this book can provide some assistance in converting sets of numbers into useable information to improve land and soil management.

References

Bell, R, Reuter, D, Scott, B, Sparrow, L, Wayne Strong W and the late Chen, W. (2013). Soil phosphorus-crop response calibration relationships and criteria for winter cereal crops grown in Australia. Crop & Pasture Science, 2013, 64, 480–498

Bell, MJ, Moody, PW, Anderson, GC, and Strong, W. (2013). Soil phosphorus–crop response calibration relationships and criteria for oilseeds grain legumes and summer cereal crops grown in Australia. Crop & Pasture Science. 64, 499-513

DPI (1993) Cation Exchange Capacity. Soil Sense 3/93. Agdex 530. NSW Department of Primary industries, North Coast Region.

Gourley, CJP, Melland, AR, Waller, RA, Awty, IM, Smith, AP, Peverill, KP, Hannah, MC. (2007). Making Better Fertiliser Decisions for Grazed Pastures in Australia Published by the Victorian Government Department of Primary Industries. ISBN 978-1-74199-208-3 (hardcopy) ISBN 978-1-74199-143-7 (online) https://www.makingmorefromsheep.com.au/globalassets/mmfs/manual/module-6/chapter-2/chapter-6.2-signpost/vic-dpi_making-better-fertiliser-decisions-for-grazed-pastures-in-australia.pdf

Gourley, CJP, Weaver, DM, Simpson, RJ, Aarons, SR, Hannah, MM, A, and Peverill, KI. (2019). The development and application of functions describing pasture yield responses to phosphorus, potassium and sulfur in Australia using meta-data analysis and derived soil-test calibration relationships. Crop and Pasture Science. 70, 1065-1079.

Heanes DL (1984) Determination of total organic-C in soils by an improved chromic acid digestion and spectrophotometric procedure. Communications in Soil Science and Plant Analysis 15, 1191-1213. doi:10.1080/00103628409367551
McKenzie NJ, Jacquier D, Isbell R, Brown K (2004) Australian Soils and Landscapes: An Illustrated Compendium. CSIRO Publishing, Melbourne.
Metson AJ (1961) Methods of Chemical Analysis for Soil Survey Samples. Soil Bureau Bulletin No. 12, pp. 168-175. NZ Department of Scientific and Industrial Research, Wellington.
Nicholas P (2004) Soil Irrigation and Nutrition. Grape Production Series No. 2. South Australian Research and Development Institute, Adelaide.
Rayment GE, Higginson FR (1992) Sampling and sample preparation. In Australian Laboratory Handbook of Soil and Water Chemical Methods. (Eds GE Rayment and FR Higginson) pp. 59-94. Inkata Press, Melbourne.
Rogers, D, Weaver, D, Summers, R, Dobbe, E, Master, R, McFerran, R, Mussell, G, Dawson, L, Mercy, J, Richards, P and Hotham, D. (2021). Critical phosphorus values from the Better Fertiliser Decisions for Pastures project: early insights from validation trials. Crop and Pasture Science 72, 731 - 741
Speirs, SD, Scott B.J, Moody, PW and Mason, SD. (2013). Soil phosphorus tests II: A comparison of soil test-crop. Crop & Pasture Science. 64, 469-479
Weaver, D, David Rogers, D, Dobbe, E, Summers, R, Master, R, Robert McFerran, R, Mussell, G, Justin Mercy, J, Luke Dawson, L, and Lynch, K. (2024). Validation of critical soil-test phosphorus values from the Better Fertiliser Decisions for Pastures, meta analysis, 75, CP23194. doi:10.1071/1/CP23194.

News from the Regions

Waikato/Bay of Plenty

Bioeconomy Science Institute (AgResearch)

Primary Industries New Zealand Awards finalists for 2025
David Wheeler's contribution to soil and nutrient management was recognised at the recent Primary Industry Summit and Awards. David was one of the finalists in the "Champion Award", which was won by his colleague Dr Robyn Dynes, Principal Scientist and Farmer Engagement Specialist.

David’s work with Overseer (nutrient budget model) has helped transform how farm nutrient management are understood in New Zealand. From early versions and concepts in the 1980s, David designed Overseer to improve farm nutrient and environmental understanding and practice. Many others have contributed to its research and supported the efforts of the whole team along the journey in the development of Overseer.

Finalists in the Champion Award:
David Wheeler, Senior Scientist, AgResearch (Bioeconomy Science Institute)
James (Jim) Ward, Manager Pāmu’s Molesworth Station

Dr Robyn Dynes, Principal scientist and farmer engagement specialist, AgResearch (Bioeconomy Science Institute)

Primary Industries New Zealand Awards finalists announced for 2025 - Brightstar

Further information on Overseer's development history since the 1980s, is available in a report from MPI:
46360-Overseer-whole-model-review-Assessment-of-the-model-approach

University of Waikato

Expansion of the WaiBER flux network
In September 2025, the Waikato Biogeochemistry and Ecohydrology Research (WaiBER) team installed two new eddy covariance towers to monitor how alternative cropping practices influence the greenhouse gas (GHG) balance and carbon (C) dynamics of farmed drained peatlands in the Waikato region. The towers are part of the REDOS (Reducing Emissions from Drained Organic Soils) project, funded by the Ag Emissions Centre in collaboration with the WaiBER team and BSI (Manaaki Whenua-Landcare Research), which aims to develop practical strategies for reducing GHG emissions from agricultural peatlands, including managing water tables, trialling alternative crops, adopting lower-intensity farming practices, and, where appropriate, retiring land for passive restoration. Data from this expanded flux network will also support the MAPSERS-C project (focused on modelling and measuring peat soil management to enhance carbon sequestration, in partnership with Manaaki Whenua-Landcare Research and Teagasc in Ireland as well as the Sustainable Peatlands Programme Mitigation Testing Project, funded by the Waikato Regional Council. The goal of these projects is to improve our understanding of GHG dynamics from peatlands drained for agriculture, identifying mitigation strategies, and support ongoing improvements to New Zealand's national greenhouse gas inventory.

Fig. 1. New eddy covariance tower.

New WaiBER team member
The WaiBER team welcomes Epernay Carta, Technical Officer, who supports environmental monitoring and field operations using eddy covariance. She holds a Bachelor of Wildlife and Conservation Biology from La Trobe University and recently completed a Master's in Ecology and Biodiversity in collaboration with Plant & Food Research. Her research investigated how apiary density influenced reproductive investment and stress physiology in honey bees (*Apis mellifera*).

Fig. 2. New WaiBER team member Epernay Carta.

Postgraduate Conference Award
Mohan KC, a PhD student in Environmental Science at the University of Waikato, received the Scott Technical Instruments Award for Best Data Acquisition Method at the 2025 School of Science Postgraduate Conference on 13 October 2025. His presentation showcased 11 years of eddy covariance monitoring of CO_2 exchange in intensively managed Waikato dairy pastures. The research assessed the impact of drought on carbon cycling by analysing drought duration and rainfall during dry periods, concluding that current droughts do not pose a significant risk for long-term carbon loss in these pasture systems. Additionally, congratulations to Mohan on the publication of the first paper from his thesis, "Quantifying the impact of grazing on ecosystem CO_2 exchange in intensively managed pastures", available at https://doi.org/10.1016/j.agee.2025.110052.

Fig. 3. Mohan KC (left) receiving the Best Data Acquisition Method award.

Farewell

The WaiBER team extends best wishes to Franco Alexis González, advised by Dori Torres-Rojas, who recently completed his time with us in New Zealand. Franco has returned to Argentina to continue as a Research and Teaching Assistant in the Edaphology Department at the Facultad de Agronomía, Universidad de Buenos Aires (UBA). We appreciated hosting Franco and valued his contributions and collaboration. We thank him for his dedication and wish him every success with his thesis and future research.

Fig. 4. WaiBER team. Franco is on front right.

Bioeconomy Science Institute (Scion)

***Pinus radiata* forests: an overlooked methane sink**
New Zealand’s 1.6 million hectares of *Pinus radiata* forests may play a hidden but important role in helping reduce the country’s greenhouse gas emissions. These forests act as natural sinks for methane (CH_4), yet this contribution is currently not accounted for in New Zealand’s greenhouse gas inventory.

To understand how much methane these forests absorb, a group of researchers at the Bioeconomy Science Institute, Scion Group, measured methane exchange between the soil and the atmosphere every month for a year at three sites across the country: Kaingaroa Forest in the central North Island, and McLeans Island and Orton Bradley Park in Canterbury.

All three sites consistently absorbed methane from the atmosphere, with average annual uptake rates of around 2.5 - 2.8 kg of CH_4 per hectare. Although uptake varied across sites and seasons, it was not strongly influenced by soil temperature or moisture, likely due to the soils’ high gas permeability along with limited environmental constraints on CH_4 uptake.

When scaled up across all *P. radiata* forests in New Zealand, this uptake represents about 113,600 tonnes of CO_2 equivalent methane removed from the atmosphere each year, enough to offset a noticeable share of methane emissions from sectors such as rail transport and natural gas production.

These findings highlight the need to recognise and further consider the methane uptake of planted forests in New Zealand's greenhouse gas accounting. Doing so would provide a more complete picture of the country's methane balance and support more effective climate change mitigation strategies.

To find out more about this research see our latest paper in Soil Research: Wigley, K., Brambilla, G., Elleouet, J., Wakelin, S.J., Clough, T.J. and Wakelin, S.A., 2025. Methane uptake in New Zealand planted forest soils. *Soil Research*, *63*(7), p.SR25011.

Bioeconomy Science Institute Scientist and Project lead Dr Kathryn Wigley demonstrating how gas samples are taken from field chambers installed in planted forests to measure how fast soil microbes are consuming methane.

Manawatū

Bioeconomy Science Institute (Plant & Food Research)

Students from Beijing Forestry University
Xiaoning Zhao and Wenhan Yang are PhD students at Beijing Forestry University (BJFU), and both have China Scholarship Council scholarships to spend 1 year in New Zealand. Xiaoning and Wenhan have completed 3 years of doctoral studies in China, and they will spend the next year in New Zealand writing up the papers for their theses. Xiaoning is based at PFR in Palmerston North with Brent Clothier, who is also an Adjunct Professor at BJFU. Wenhan is at Lincoln University. Wenhan visited PFR Palmerston North for 10 days in late October. While in Palmy, Xiaoning and Wenhan gave presentations to the PFR Land Use Impacts team, and retired Professor Alex Chu from Massey University attended. Alex's area of research was water-stress in pasture plants, and he was doing his PhD in

DSIR's Climate Laboratory in Palmy and the same time as Brent was doing his. A long time ago!

Retired Professor Alex Chu, Xiaoning Zhao and Wenhan Yang discussing water use by *Poplar tomentosa* trees at PFR in Palmerston North.

Xiaoning's research is on accurate determination of tree water-use using thermal methods of sap flow measurement, plus the upscaling of water-use observations from the xylem-scale though the whole-tree to the plantation scale. Wenhan's studies focus on patterns of deep-soil root-water uptake, and the presence of the so-called 'dried soil layer' in the rootzone and its impact and how its effects can be ameliorated to enable both tree production and groundwater recharge.

Brown kiwi, green beaks: new research explores kiwi potential for pest management in horticultural landscapes.

New research has uncovered a potential partnership between Aotearoa New Zealand's national icon, the brown kiwi, and growers, providing new insights into the flightless birds' behaviour in horticultural landscapes.

With a population of around 26,000, the North Island brown kiwi has increasingly been observed in orchards and vineyards, prompting an investigation into their potential role as natural pest managers as part of a research collaboration between Te Kunenga ki Pūrehuroa Massey University and the Bioeconomy Science Institute.

Building on earlier pilot work from the Bioeconomy Science Institute, Massey University master's student Wei (Xosha) Gong spent a year conducting fieldwork across four sites, using camera and acoustic recorders, insect traps and faecal analysis to build a picture of kiwi behaviour, diet and predator presence.
"This research involved a significant amount of biodiversity monitoring. I collected 13,724 videos from camera traps as well as 1,073 audio recordings and used these to identify bird and mammal species," Xosha says.

Results showed that while kiwi remain most active in surrounding native bush, they also regularly move into and forage in the orchards and vineyards they live alongside. Diet analysis revealed they consume a wide range of invertebrates, including several horticultural pests.

Bioeconomy Science Institute scientist and supervisor Karen Mason says these findings highlight a dual opportunity, where horticultural landscapes can provide supplementary habitat for kiwi, and kiwi can help contribute to natural pest regulation.

"Horticulture, and agriculture more broadly, can be more than places where we grow food; they can become habitat and corridors for our wildlife. By understanding how growing systems are interacting with these taonga species, we can design landscapes to support them. It's a win-win, as increasing biodiversity increases a system's resilience," Ms Mason says.

She adds that similar approaches overseas have benefitted growers.
"Research in Colombia shows coffee growers have found that integrating native species into their systems provides valuable ecosystem services and improves crop performance. They then have the marketing bonus of labelling coffee as bird friendly. We could have kiwi friendly kiwifruit and wine here!"

While the findings have revealed valuable insights, the study is still in its preliminary stages and more research is needed to understand how to develop sustainable and meaningful partnerships between kiwi, or other taonga species, and horticulture.

Key recommendations from the study to help this relationship thrive include better predator control, enhancing orchard habitat, testing fenced versus unfenced areas to measure kiwi impacts on pests, soil and biodiversity, and partnering with growers to align kiwi conservation with horticultural management.

Massey's Professor in Wildlife Biology and supervisor Professor Isabel Castro says land management practices that retain native vegetation and use under-canopy planting in orchards are likely to encourage greater kiwi presence.

"Across New Zealand, we are losing precious biodiversity due to introduced predators, deforestation and the reshaping of habitats. Yet there is hope: by welcoming kiwi into our orchards and farms, these birds might once again help restore balance, feeding on pests and giving back to the land," Professor Castro says.

"In Mātauranga Māori, when the forest was suffering from insect pests, Tāne Mahuta asked the birds for help, and it was the kiwi who answered, giving up flight and the light of day to protect the ngahere [forest or bush]. Science tells us this choice is mirrored in evolution: kiwi adapted to New Zealand's unique environment by becoming nocturnal, ground-dwelling insect hunters. In this way, story and science meet, and perhaps, in this new age of loss, the kiwi's gift can help us once more."

The study was funded by the Rejuvenating Crop Ecosystems programme in Growing Futures – Ngā Pou Rangahau at Plant & Food Research, which is now part of the Bioeconomy Science Institute. It was further supported through the supervision of Massey University Professor in Ecology Alastair Robertson.
This research was recently featured on RNZ's Country Life podcast (https://www.rnz.co.nz/news/country/576271/country-life-harnessing-the-power-of-kiwi-in-horticulture)

Bioeconomy Science Institute (Manaaki Whenua - Landcare Research)

Soil Horizons
Soil Horizons is our annual web-based newsletter updating stakeholders on recent soil and environmental research. This issue of Soil Horizons is our first as part of the new Bioeconomy Science Institute.

https://www.landcareresearch.co.nz/publications/soil-horizons

The articles are:
Stamp of approval: NZ Post releases soil stamps
Digging for treasure: How a new AI tool assists with intergenerational knowledge discovery
Hole truths: The importance of soil judging competitions in soil management and skills development
Modernising the New Zealand *Soil Description Handbook* for the 21st Century
Major expansion of S-map coverage in Taranaki
How many landslides were prevented during Cyclone Gabrielle?
Can incorporation of plantain into pasture reduce nitrous oxide emissions from urine patches in livestock grazing systems?
Biochar incorporation into soils: initial effects and challenges
Can winter-sown catch crops reduce nitrate leaching in cold environments?
Expanding our horizons – further coverage for S-map
Better nitrogen management: The answer lies in the soil

Anatolii Tsyplenkov left the erosion modelling team to return home. Anatolii has been working on modelling the benefit of trees for building resilience in our landscapes to rainfall-triggered landslides from Cyclone Gabrielle, and landslide connectivity in Hawke's Bay to identify areas where future landslides are more likely to reach streams. See abstracts for their recent paper.

Massey University

MASSEY UNIVERSITY
SOIL SOCIETY

South Taranaki is famous for its beautiful volcano, lush dairy pastures and left-hand surf breaks. It is also the centre of New Zealand’s oil and gas industry, including Kāpuni, the first major gas field to go into production in 1969 (Fig. 1). Drilling for oil and gas in Taranaki involves a drill rig that bores a well through several kilometres of sedimentary rock. As the well is drilled deeper, different sized drill bits are used and steel casing and cement are inserted and pumped around the well to seal and provide structural support. Drilling mud is pumped down the well where it sprays out of nozzles to clean and cool the drill bit. The mud carries rock cuttings up to the surface where they are screened out and the mud returns to pits where fines are allowed to settle out. The returning mud can contain natural gas which is separated and vented or flared. A series of emergency valves are located at the top of the well to allow it to be sealed in case of encountering unexpected pressure changes and preventing blowouts.

Figure 1. Kāpuni gas field located near the small south Taranaki township of Kaponga, 65km south of New Plymouth (Lloyd Homer, 1990; GNS VML ID: 44964).

Drilling mud is expensive and is constantly being modified, cleaned and recycled during the drilling process to enhance recovery and minimise the volume for disposal. The mud provides hydrostatic pressure to keep formation fluids out of the bore and control formation pressure, cool and lubricate the drill bit and carry cuttings up to the surface. The mud is adjusted in the pits during drilling with additives to ensure it has the right properties to improve drilling efficiency and borehole stability.

A range of additives are used to change mud properties including weighting agents such as sodium chloride and barite to control formation pressures, bentonite and synthetic carbon compounds to increase viscosity and borehole stability, potassium chloride to control swelling and sodium hydroxide (caustic soda) to control pH. Drilling mud can contain benzene, toluene, ethylnenzene and xylene and Polycyclic Aromatic Hydrocarbons. In general, Taranaki drilling mud is low in heavy metal concentrations due to the nature of the geology.

Once the drilling mud has reached its end of life it is disposed of at a landfill or using a consented land-based disposal technique called ‘landfarming’. The landfarming process has been used in south Taranaki to convert erosion-prone, sandy coastal sites into productive pasture. This involves stockpiling topsoil, recontouring the land to create a near flat surface, applying a thin layer of waste and working it into the underlying sand before re-applying topsoil. Dilution, atmospheric degradation and natural bioremediation then reduces the concentration of hydrocarbon compounds.

Massey University is studying the long-term changes in soil properties and pasture production attributed to landfarming. The Massey University Soil Society took an opportunity to visit and meet with industry in South Taranaki on Saturday 11th of October 2025. The group of undergraduate and postgraduate students travelled by bus from Palmerston North. Following a health and safety briefing the group set off to see a range of key points of interest around the landfarm. This was a great opportunity to examine areas where drilling mud had been applied to land, examine the resulting soil profile and then compare back to adjacent natural dune landforms and soil profiles. Despite a foreboding weather forecast the group managed to stay remarkably dry and the sun even made a brief appearance. A catered lunch was shared before thanking the hosts and travelling back to Palmerston North.

Figure 2: A group of 41 students meeting with industry to learn more about applying drilling mud to land in South Taranaki.

Whenua Haumanu Update
Sumaia Mahmuda, from Bangladesh, has recently begun her PhD within the Whenua Haumanu Programme (Figure 1). She holds a BS (Hons) in Agriculture and an MS (Hons) in Horticulture. She is passionate about finding practical solutions to help farming work in harmony with the environment.

Her doctoral research, "*Impact of Diverse Pastures and Regenerative Management on Nutrient Uptake and Leaching Losses in a Dairy Agroecosystem*", will explore how pasture diversity and regenerative management influence nutrient use efficiency, soil water dynamics, and leaching below the root zone. By identifying pasture compositions and management approaches that improve nutrient retention and water quality, her work will provide practical, evidence-based strategies for reducing environmental impacts while maintaining productive farming systems.

Sumaia says, "*My research aims to examine if diverse pastures and regenerative management practices can work together to boost nutrient uptake, minimise nutrient losses, and improve soil and water health. By bridging science and practical farming, I hope to equip farmers, researchers, and policymakers with tools and knowledge that protect waterways, support resilient production, and ensure the long-term sustainability of New Zealand's pasture systems.*"

She is supervised by Lucy Burkitt, Craig McGill, James Hanly, and David Horne.


Figure 1: Sumaia Mahmuda sampling on Massey University Dairy 1 in Palmerston North.

Canterbury and Otago

Lincoln University

Soil Judging Competition - Armidale
Lincoln University is sending five students to Armidale, Australia, from November 25th to 29th to compete in the Soil Judging Competition.

Soil Judging is about developing your skills and knowledge in soil description and classification. Students will fine-tune their skills in areas such as texturing, soil structure, soil chemistry, and classifying soils for various land uses.

Lincoln has a strong history in Soil Judging since 2016 – Competing against universities from NZ, Aussie and even the U.S.! - Students have had the privilege of travelling to Wanaka, Golden Bay, Napier, Marlborough, Adelaide, Canberra, Darwin, Brisbane and Rotorua!

The photo shows the three teams that competed in the 2023 Soil Judging Competition in Darwin, Australia.

Winning Three Minute Thesis is a "masterclass" – Lincoln University

"In all my years of judging, I can't remember such a remarkable depth of talent."

Those are the words of David Dannenberg, a judge of Lincoln University's annual Three Minute Thesis competition.

The event challenges postgraduate students to explain their research in just three minutes, forcing them to cut out the nitty-gritty and focus on effective communication.

This year's competition was full of incredible competitors, but only one could be crowned the victor. That was Ksenia Trifonova, PhD student in Soil and Physical Science, who seamlessly explained how simulated outdoor environments, called mesocosms, could be used to research sediment in river water circulation systems.

Phuc Nguyen (Luna), another PhD student in Soil and Physical Science, came second with her research on the potential of biochar, and Nathan Campbell came third, speaking on how garden design can help biodiversity and prevent wildfires. Judge David Dannenberg said it was the strongest selection of speakers he had ever seen for the competition.

"The calibre of speakers at this year's 3MT competition was exceptional.
"Each speaker wonderfully demonstrated both a command of their research topic and the ability to communicate complex ideas in a clear and captivating manner."

Ksenia was unanimously chosen by all three judges as the top presenter.
David said her presentation was “a masterclass” on communicating scientific information to a general audience.

“Her presence was captivating and effortlessly blended clarity, enthusiasm and passion. Her ability to convey complex ideas in such a compelling manner not only impressed the judges but also left the audience both enlightened and entertained.”
By Ryder, Wyatt

HZAU – Lincoln University Joint Institute of Higher Learning
Photos and words from the Senior Lecturer, Dr Sebastian Naeher, from Huazhong Agricultural University, where he is part of the Huazhong Agricultural University-Lincoln University Joint Institute of Higher Learning team:

“The photos are from the labs teaching about the different types of rocks, three labs each (and each lab split over two rooms except when I provide the introduction and instructions, which is why in some photos there are so many more students). As you see, food is always fantastic here too! Also, photos from the Soil Specimen Museum, as they call it, where we did some teaching of soil profiles and classifications. We also looked at local soils nearby with the students and showed them how to describe and characterise soils.”



Luna's mission to understand biochar, the "superhero" material

Biochar could be a “superhero” material for our land-based industries, but winemakers are spending hundreds of thousands to dispose of its main ingredient.

Luna Nguyen wants to help change that. She’s a Soil and Physical Science PhD student at Lincoln University, studying how to make biochar from waste grape products more efficiently. She successfully presented her work at Lincoln’s Three Minute Thesis finals, which won her second place.

Biochar is an incredibly carbon-rich material derived from organic matter. It’s made by heating biomass while depriving it of oxygen, a process called pyrolysis. Without oxygen, the material can’t catch fire, leaving you with dense pure carbon instead.

However, we lack research on the most effective way to make it. Temperatures for pyrolysis can vary from 300°C to 900°C. Luna’s on a mission to find out which exact method results in the most effective biochar.

She’s focusing on grape marc, the solid remains leftover from grapes after pressing. It contains the skin, seeds, pulp and stems. New Zealand’s winemaking industry makes about 50,000 tonnes of grape marc every year. “People have tried to turn grape marc into compost, but it takes time, labour and a huge amount of space,” Luna says. “It also produces greenhouse gas emissions, and it can leach into and contaminate soil and water.

“Most winemakers are paying to landfill it, but it costs a lot of money.”

Biochar is remarkably versatile. When added to soil, it acts as a slow-release fertiliser, increases water retention and helps maintain a healthy pH level. It can help purify water from heavy metals, and it can be burned as a fuel source. In the long run, biochar can play a crucial role in mitigating climate change due to its capacity for carbon sequestration.

“It’s kind of a superhero.” Converting grape marc to biochar reduces the total mass to one-third, which means wineries would save significant space on storage as well.

Luna believes there is big potential for winemakers to profit from biochar, but at the moment, production costs are too high. By studying the best conditions for pyrolysing grape marc Luna could help make it more accessible and normalise it within the industry.

She’s producing five different types of biochar, then adding it to soil around native plants. In time she’ll discover which grade of biochar worked best as a soil amendment and what impacts it had on the surrounding soil.

“It’s about the long-term story. I’m looking at a dream material that can fix a lot of things, but there’s a lot that goes into the financial side of things. I think we’ll have to wait and see.”
By Ryder, Wyatt

Bioeconomy Science Institute (Manaaki Whenua - Landcare Research)

Chris Phillips retires

Principal Researcher, Chris Phillips has retired from the Manaaki Whenua – Landcare Research group within the Bioeconomy Science Institute. Chris has made more than 45 years of contribution to shape the science of erosion and catchment management across Aotearoa New Zealand.

Colleagues of past and present gathered in Lincoln and Palmerston North to celebrate Chris's career, hearing of his scientific achievements, leadership across science portfolios, and influence in shaping government policy and legislation. They reflected on Chris's guidance as a mentor and his commitment to working with communities and partners, as well as the values and humour that made him a trusted colleague and friend.

From Chris's first role as a technician with the Forest Research Institute, he quickly rose to Programme Leader, completing his PhD in Agricultural Engineering at Canterbury University and demonstrating a remarkable drive and commitment to advancing his field. Chris joined Manaaki Whenua – Landcare Research in 1992. Over three decades, he served in several leadership roles. Early in his career, Chris studied the relationship between geology and geomorphology and its implications for forest management in the Gisborne-East Coast region.

Chris had a key role in the Motueka River Integrated Catchment Management programme (2000-2011). He co-led the Smarter Targeting of Erosion Control (STEC) programme (2019-2024), which developed cost-effective methods for erosion control through identification of erosion sources and mitigation measures.

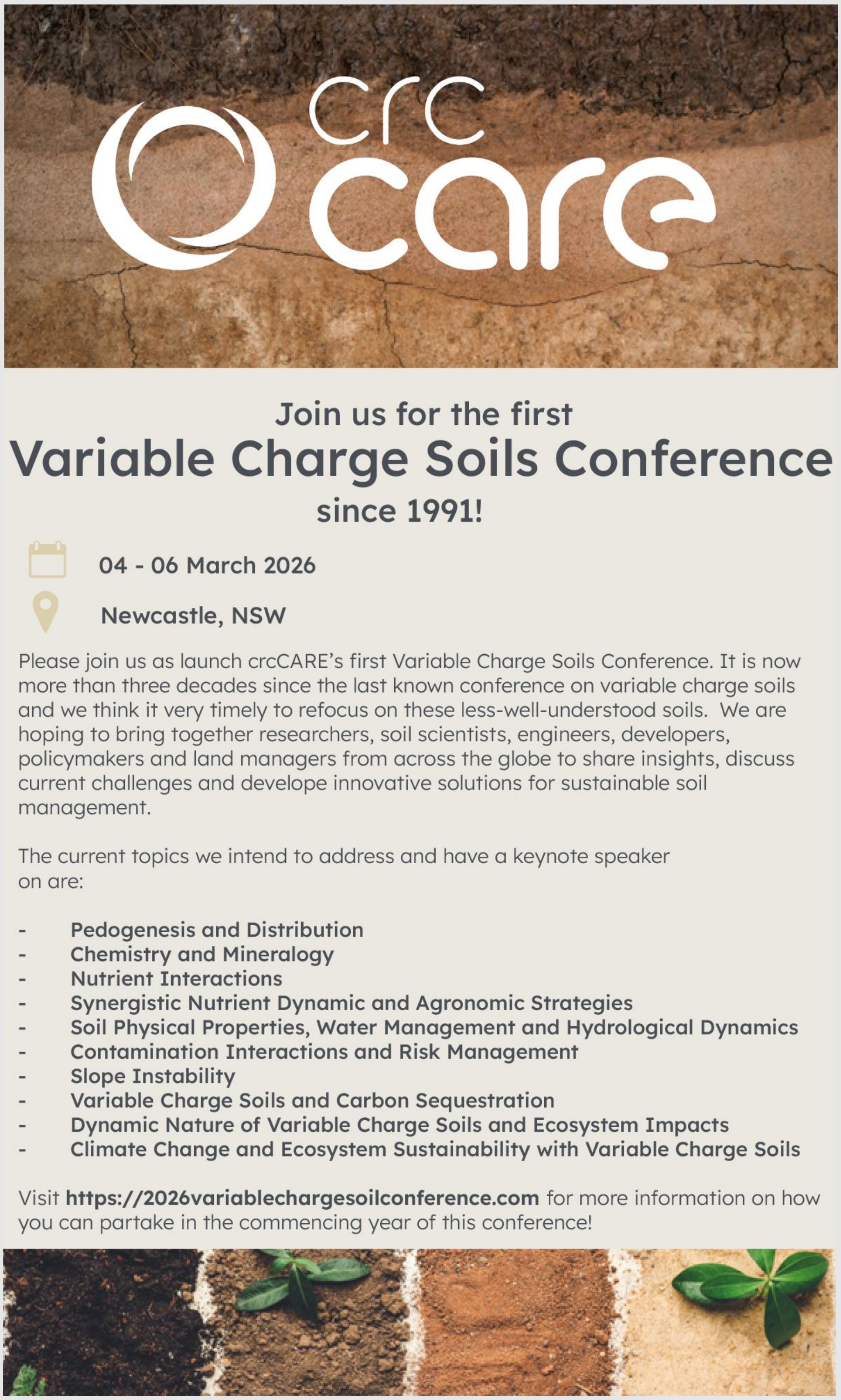
Chris has an outstanding publishing record: contributing to around 80 journal articles, nine books, and over 50 conference proceedings. His work has been cited over 4,000 times, reflecting sustained influence in his field. Chris's contributions were also recognised through numerous awards. His expertise has been sought by regional and central government, influencing legislation, policy, and practical land and water management strategies.

We wish Chris every success and enjoyment in his next chapter – and celebrate the legacy he leaves behind.

Chris Phillips in action investigating extent of tree roots. Chris has published many papers on erosion control, including on tree roots, e.g. 'Tree root research in New Zealand: a retrospective 'review' with emphasis on soil reinforcement for soil conservation and wind firmness'. https://doi.org/10.33494/nzjfs532023x177x

Conferences

Soils with Variable Charge Conference



The 2026 conference will be held from **4-6 March 2026** at the **Newcastle Exhibition & Convention Centre (NEX), Newcastle, New South Wales, Australia**.

The event will bring together leading researchers and practitioners to explore the chemistry, reactivity, and environmental implications of variable charge soils.

Topics will include their interactions with key nutrients (N, P, S), toxic elements, pesticides, and organic contaminants, as well as advances in colloid and interface science.

Given that **both Australia and New Zealand contain extensive areas dominated by variable charge soils**, we see this conference as a valuable opportunity to strengthen trans-Tasman collaboration, share new research findings, and inspire the next generation of soil scientists.

Further details, including themes, confirmed speakers, and registration information, are available at:
👉 https://2026variablechargesoilconference.com/

International Conference on Geomorphology

Christchurch, 2-6 February 2026.
https://www.confer.co.nz/icg2026/

23rd World Congress of Soil Science

This esteemed event will take place in Nanjing, China, from June 7 to June 12, 2026, and we eagerly anticipate your participation in this international gathering. Theme: 'Soil and the Shared Future for Humanity'.

Since its inception in 1927, the World Congress of Soil Science has been convened every four years, serving as a pivotal scientific forum in the realm of soil sciences. The Soil Science Society of China won the bid in 2018 to organize WCSS2026 in Nanjing.
https://www.23wcss.org.cn/

News from the European Soil Data Centre

New publications

López i Losada R, Hedlund K, Haddaway NR, Sahlin U, Jackson LE, Kätterer T, Lugato E, Jørgensen HB, Isberg P-E 2025. Synergistic effects of multiple "good agricultural practices" for promoting organic carbon in soils: A systematic review of long-term experiments. Ambio. https://doi.org/10.1007/s13280-025-02188-8

Van Eynde E, Ros GH, Yunta F, Muntwyler A, Hinsinger P, Fendrich AN, Panagos P 2025. Opportunities for optimizing phosphorus inputs in EU agricultural soils. Environmental Science & Policy 171: 104168.
https://doi.org/10.1016/j.envsci.2025.104168

Continental scale soil monitoring
Selecting appropriate soil indicators across Europe is challenging due to diverse climate, topography, geology, and soil types. Therefore, establishing clear principles and criteria for soil indicator selection is essential. Four distinct frameworks for soil quality assessment were identified and described.
Campbell GA, et al. 2025. Continental Scale Soil Monitoring: A Proposed Multi-Scale Framing of Soil Quality. *European Journal of Soil Science* 76, no. 4: e70174. https://doi.org/10.1111/ejss.70174.
Panagos P, and others 2024. How the EU Soil Observatory is providing solid science for healthy soils. European Journal of Soil Science 75(3): e13507.
https://doi.org/10.1111/ejss.13507

New soil sampling protocols published to harmonise European soil health monitoring
A key contribution towards standardised soil health monitoring in Europe has been achieved with the release of three comprehensive soil sampling protocols developed under the Mission Soil-funded project BENCHMARKS. The protocols are being updated in line with the needs of the proposed Soil Monitoring Law.
Soil Health Benchmarks
Mason E, and others 2025. Monitoring systems of agricultural soils across Europe regarding the upcoming European soil monitoring law. European Journal of Soil Science 76(4): e70163. https://doi.org/10.1111/ejss.70163.

Global Soil Organic Carbon displaced due to erosion
Soil erosion significantly affects soil organic carbon (SOC) dynamics, impacting carbon neutrality and climate change mitigation. Global SOC loss from erosion is estimated at approximately 0.97 Pg C/year. Reference: Yoon, et al. 2025. Impact of soil erosion on soil organic carbon loss and its implications for carbon neutrality. Advances in Agronomy, 191: 363-414.

Council adopts new rules for healthier and more resilient European soils
The Council formally adopted the soil monitoring and resilience directive – the first-ever EU-wide framework for assessing and monitoring soils. It aims to achieve healthy soils across Europe by 2050. This directive is a major step towards more resilient soils, improved food security and cleaner water and environment.
Council adopts new rules for healthier and more resilient European soils - Consilium

Healthy soils as a booster to EU competitiveness
The EU's strategic agenda for 2024-2029 prioritizes a prosperous and competitive Europe, with soil health potentially playing a role in achieving this goal. In a new paper, we present and discuss a set of examples on how soil-related business models increase EU competitiveness, including biotechnology, remediation of contaminated sites, carbon removals and farming, regenerative agriculture, and agritech solutions.

Publication: Panagos P, et al. 2025. Healthy soils as a booster to EU competitiveness. Land Use Policy 158: 107755.

2nd Carbon Farming Summit
Dublin, March 2025. Publication: Zimmer, D et al. (2025). 2nd European Carbon Farming Summit - Analysis of Session Recommendations. https://doi.org/10.5281/zenodo.17277141

Contributions for the 3rd European Carbon Farming Summit
The Call for Contributions for the 3rd European Carbon Farming Summit is now open! March 2026. EU Carbon Farming Summit

Abstracts

Li J, Hu W, Langer S, Malcolm BJ, Maley S, Jenkins H, Carey P 2026. Catch crops promote soil physical recovery after forage crop grazing. Soil and Tillage Research 255: 106778. https://doi.org/10.1016/j.still.2025.106778

Soil compaction-induced physical degradation is a threat to sustainable crop production and environmental performance. While measures have been evaluated to alleviate compaction, the impact of catch crops establishment on soil physical recovery following winter grazing remains underexplored. Six New Zealand trials over different years investigated: (1) the effects of soil compaction induced by winter forage crop grazing on soil health, and (2) the effectiveness of catch crops establishment in facilitating soil recovery. Our findings revealed that winter grazing resulted in significant soil physical degradation in the top 10 cm, evidenced by significant reduction in total porosity, macroporosity, available water content, saturated hydraulic conductivity (Ks), and soil quality *S* index. The degree of soil degradation was higher under increased grazing intensity (fodder beet grazing compared with kale grazing) and wetter conditions. For example, in Te Pirita-2019 with kale, changes in Ks were not significant. However, in Te Pirita-2019 with fodder beet, Ks decreased significantly from 1548 mm day^{-1} to 88 mm day^{-1}, representing a 94.3 % reduction. Compared with fallow after grazing, growing catch crops promoted soil restoration. Conventional moldboard ploughing and the recently introduced single-pass ‘spader-drill’ outperformed direct drill for soil recovery. This study highlighted the importance of catch crop establishment using conventional tillage and spade drill to mitigate soil degradation resulting from winter forage crop grazing. The spader-drill, where soil conditions allow, is preferred because it allows earlier sowing of catch crops, leading to broader benefits such as increased crop biomass and reduced nitrogen leaching.

Wiffen K, Lakshani T, Deepagoda C, Carrick S, Clough TJ, Cameron K, Di H, Hu W, Beare M, Clothier B and others 2025. Representing air as imaginary water: Analysis of soil water and soil aeration corequisites for plant growth. Vadose Zone Journal 24(5): e70037. https://doi.org/10.1002/vzj2.70037

Plant-available water and adequate soil aeration are two fundamental requirements for successful plant growth. These prerequisites have generally been assessed independently in relation to plant growth, with limited focus on their complementary and competing behavior in a soil-water matrix. In this study we introduce a corequisite index adopted from a complex number representation by linking soil-water (the real component) and soil-air (the imaginary component) as the orthogonal counterparts in an Argand diagram. The new corequisite index constitutes a soil-water component defined based on field capacity and permanent wilting point, and a soil-air component defined based on critical soil-gas diffusivity. To calibrate model parameters, the soil-water characteristics were measured in vadose soil profiles (0- to 60-cm depth) from 48 replicate sites. Results revealed that the corequisite index, with its magnitude (0.5-1) and corequisite angle (0-30°) in the given range, provided the best combined soil water and aeration status for the selected soil. The majority of the selected soils were affected by insufficient aeration (gas diffusivity < 0.01) when at field capacity (drained to −10 kPa), requiring the soils to drain further (−50 to −100 kPa) to satisfy the corequisites. The derived soil aeration parameters showed promising relationships with measurable soil physical properties. We further recommend adopting a 15% volumetric soil air content as a general threshold for minimum soil aeration in the absence of measured soil-gas diffusivity data.

Tsyplenkov A, Smith HG, Betts H, Neverman AJ 2025. Data-driven analysis of shallow landslide-to-stream connectivity. Global and Earth Surface Processes Change 2: 100002. https://doi.org/10.1016/j.gespch.2025.100002

To improve freshwater quality and reduce sedimentation, detailed information on sediment delivery by rainfall-induced shallow landslides to stream channels is needed to better target mitigations. Data-driven landslide connectivity analysis can address this issue by identifying areas where future landslides are more likely to reach streams. We investigated landslide-to-stream connectivity using a comprehensive inventory of shallow landslides, focusing on a study area in Hawke's Bay, New Zealand, affected by intense rainfall in March 2022. We tested eleven logistic regression models, each with various parameter sets covering morphometry, land cover, lithology and landslide morphology. The most influential factor on connectivity was the overland flow distance to the stream network. A single-variable logistic regression model based on downslope distance achieved an AUROC of 0.84, demonstrating good predictive power. We assessed the models' spatial transferability using an independent landslide inventory from another region with similar terrain, where the single-variable model maintained an AUROC of 0.84. Our analysis revealed no significant dependency of connectivity on land cover or near-surface lithology. However, landslides on pasture had significantly greater runout distances compared to native forests (with the same landslide source area), suggesting that land cover characteristics may influence connectivity. This study highlights the importance of detailed landslide connectivity analysis for targeting erosion control. We conclude that the single-variable model, based on downslope distance to the stream network, provides a robust and transferable tool for predicting landslide connectivity.

Heydari A, Kim ND, Biggs PJ, Horswell J, Gielen GJHP, Siggins A, Bromhead C, Meza-Alvarado JC, Palmer BR 2025. Antibiotic and heavy metal resistance in bacteria from contaminated agricultural soil: insights from a New Zealand airstrip. Antibiotics 14(2): 192. https://doi.org/10.3390/antibiotics14020192

Background/Objectives: Agricultural soils accumulate inorganic contaminants from the application of phosphate fertilisers. An airstrip located at Belmont Regional Park (BRP), near Wellington, New Zealand, has been found to have a gradient of cadmium contamination due to spillage of superphosphate fertiliser. Methods: Soil samples from the BRP airstrip with a gradient of cadmium contamination, were used as a novel source to explore bacterial communities' resistance to heavy metals (HMs) and any co-selected antibiotic (Ab) resistance. Results: Differences between BRP soil samples with higher levels of HMs compared to those with lower HM concentrations showed significantly more bacterial isolates resistant to both HMs (40.6% versus 63.1% resistant to 0.01 mM $CdCl_2$, $p < 0.05$) and Abs (23.4% versus 37.8% resistant to 20 µg/mL tetracycline, $p < 0.05$) in soils with higher initial levels of HMs (1.14 versus 7.20 mg kg^{-1} Cd). Terminal restriction fragment length polymorphism (TRFLP) and 16S rDNA next-generation sequencing profiling investigated changes in HM-induced bacterial communities. Significant differences were observed among the bacterial community structures in the selected BRP soil samples. Conjugative transfer of cadmium resistance from 23–38% of cadmium-resistant isolates to a characterised recipient bacterial strain in vitro suggested many of these genes were carried by mobile genetic elements. Transconjugants were also resistant to zinc, mercury, and Abs. Higher levels of HMs in soil correlated with increased resistance to HMs, Abs, and elevated levels of HMs thus disturbed the bacterial community structure in BRP soil significantly. Conclusions: These findings suggest that HM contamination of agricultural soil can select for Ab resistance in soil bacteria with potential risks to human and animal health.

Gillespie J, Payne M, Payne D, Edwards S, Jolly D, Smith C, Cavanagh JA 2025. Research at the interface between Indigenous knowledge and soil science; weaving knowledges to understand horticultural land use in Aotearoa / New Zealand. Soil 11(2): 583-607. https://doi.org/10.5194/soil-11-583-2025

Addressing the complex challenges of soil and food security at international and local scales requires moving beyond the boundaries of individual disciplines and knowledge systems. The value of transdisciplinary research approaches is increasingly recognised, including those that value and incorporate Indigenous knowledge systems and holders. Using a case study at Pōhatu, Aotearoa / New Zealand, this paper demonstrates the value of a transdisciplinary approach to explore past Māori food landscapes and contribute to contemporary Māori soil health and food sovereignty aspirations. Engaging at the interface between soil science and Indigenous knowledge (mātauraka Māori) in an Aotearoa / New Zealand context, we provide an example and guide for weaving knowledges in a transdisciplinary context. Here, mātauraka Māori, including waiata (songs) and ingoa wāhi (place names), provided the map of where to look and why, and soil analysis yielded insight into past cultivation, soil modification, and fertilisation practices. Both knowledges were needed to interpret the findings and support Māori in re-establishing traditional horticultural practices. Furthermore, the paper extends the current literature on the numerous conceptual frameworks developed to support and guide transdisciplinary research by providing an example of how to do this type of research in an on-the-ground application.

Rogers KM, Bradshaw D, Scadden P, Tschritter C, Sanderson S, Cooper J, Phillips A, Pannell J, Thern J, Abel S , et al. 2025. Nitrate contamination in New Zealand's domestic drinking water with a focus on rural groundwater-sourced self-supplies. Science of the Total Environment 1002: 180549.
https://doi.org/10.1016/j.scitotenv.2025.180549

Nitrate contamination is a major threat to freshwater quality with serious implications for ecological and human health. We report on New Zealand's largest drinking water nitrate investigation with more than 3800 samples collected nationally between 2022 and 2024. New Zealand's drinking water standards (NZDWS) do not require chemical testing of domestic rural groundwater self-supplies (from bores and springs), so are more vulnerable to nitrate contamination due to reliance on shallower groundwater and proximity to livestock in rural areas.

This study overwhelmingly confirms that Canterbury has the largest percentage of elevated groundwater nitrates in New Zealand. NZDWS has a maximum acceptable value for nitrate-nitrogen (MAV of 11.3 mg/L NO_3-N) which was exceeded in 6.8 % of rural samples from Canterbury, while 43.1 % exceeded ½ MAV (5.65 mg/L NO_3-N). Waikato and Southland (each with 15.0 % and 39.9 % of samples exceeding ½ MAV, and 2.9 % and 4.6 % exceeding MAV, respectively) had the highest maximum nitrate values (34.0 and 140 mg/L NO_3-N). The national database also signals emerging regions of concern, including Bay of Plenty, Hawke's Bay, Taranaki, Manawatū-Whanganui, Wellington, Nelson, Tasman and Otago with 9.4 % to 24.5 % of samples exceeding ½ MAV, and up to 7.5 % exceeding MAV. Using a dual nitrate isotope approach ($\delta^{15}N_{NO3}$ and $\delta^{18}O_{NO3}$), dairy effluent is identified as a primary cause of high nitrate levels found in these groundwaters.

In this nationally significant study, 30.9 % of rural drinking water samples tested over ½ MAV and 5.1 % exceeded MAV, signalling a widespread and concerning threat to freshwater quality across multiple regions. The study identified 142 samples with nitrates exceeding NZDWS MAV, affecting more than 600 residents. Based on an estimated 646,600 rural residents in New Zealand using groundwater-sourced drinking water, there could be upwards of 21,200 people drinking nitrate contaminated water above MAV, and 101,000 people drinking water above ½ MAV across rural New Zealand.

Editor's note: Expert rection and media:
High nitrate levels found in rural NZ drinking water - Expert Reaction - Science Media Centre

Tamepo RL, Doscher C, McDowell RW 2025. Are there clear benefits from diversification of land use: a review and preliminary meta-analysis? Journal of the Royal Society of New Zealand 55(6): 2060-2081.
https://doi.org/10.1080/03036758.2025.2496373

Diversified farming systems are often considered more resilient and environmentally sustainable than monocultures. However, their performance on key environmental and economic outcomes remains poorly defined across different contexts. We reviewed the literature and examined data from 277 sites, primarily in New Zealand, regarding the merits of land-use diversification. We tested the hypothesis that nitrogen (N) and phosphorus (P) losses to freshwater (kg/ha), greenhouse gas (GHG) emissions, and job creation differ between farm and catchment scales and that diversification can reduce these environmental losses. Our findings indicate that, contrary to expectations, N losses were higher in diversified systems compared to monocultures at farm scale, and catchment scale. This increase was largely attributed to land-use changes and cultivation practices. However, the total number of jobs was higher in diversified systems at both scales. Although heavily context-dependent, these observational data provide a rationale to determine the conditions under which diversification can improve environmental and economic outcomes. Beyond biophysical conditions, additional challenges in implementing diversification lie in the phasing and implementation of catchment policies at the farm scale, robust supply and value chains to adapt to market demands, and the need to develop and implement technology fit for varied (and diversified) farm systems.

Journal of the Royal Society of New Zealand

The Journal of the Royal Society of New Zealand has a special issue (vol 55, no 6): The National Science Challenge Experiment: legacy and lessons.

Journal of the Royal Society of New Zealand: Vol 55, No 6

Examples below, but there are more:

Quantifying a different way of doing research in the Our Land and Water National Science Challenge. https://doi.org/10.1080/03036758.2024.2432426

Better resourcing of Te Tiriti-led collaboration can be a National Science Challenge legacy. https://doi.org/10.1080/03036758.2025.2475812

Building mission-led science communication and engagement capability in Aotearoa New Zealand: lessons from the National Science Challenges. https://doi.org/10.1080/03036758.2025.2463468

Hu W, Lawrence-Smith E, Tregurtha C, Meenken E, Beare M 2025. Enhancing soil penetration resistance measurements and interpretations: Normalising for moisture variability to better assess land use effects. Geoderma 463: 117572. https://doi.org/10.1016/j.geoderma.2025.117572

Cone penetration resistance (PR) is an important index of soil physical restriction to root growth in agriculture. Spatio-temporal variability of soil water content (SWC) makes PR data less comparable. Our objective was to normalise spatio-temporal PR measurements to a standard SWC, thus allowing comparison across New Zealand's agricultural regions. We geo-referenced 497 measurements of PR and SWC from two depths (0-15 and 15-30 cm) in multiple agricultural regions between

2002 and 2007. Power, exponential, and logarithmic models were used for fitting PR as a function of SWC. A power function relating PR to gravimetric water content (GWC) provided the best-fit model for normalising PR for variation in SWC. Low relative errors (<10 %) and absolute errors (<0.2 MPa) were obtained at both depths for GWC values of 0.16-0.26 g g^{-1}. We recommend GWC of 0.16-0.26 g g^{-1}, with 0.20 g g^{-1} preferred for its proximity to the midpoint and its associated lower relative error (5 %). Specific models for different land use categories were unnecessary, while soil-depth-specific models for different soil orders (Allophanic cf. Non-Allophanic) improved the PR normalisation. Normalised PR values (GWC = 0.20 g g^{-1}) for pastoral soils were higher than for cropping soils, particularly at 0-15 cm. About 65 % and 75 % of the sampled sites had normalised PR values exceeding 2.5 MPa at 0-15 and 15-30 cm depths, respectively, indicating the potential for adverse effects from widespread soil compaction. This study highlights the importance of normalising PR data for soil moisture variation to better assess potential adverse effects of land use and management on soil.

KC M, Wall AM, Goodrich JP, Schipper LA 2026. Quantifying the impact of grazing on ecosystem CO2 exchange in intensively managed pastures. Agriculture, Ecosystems & Environment 397: 110052.
https://doi.org/10.1016/j.agee.2025.110052

Grazing alters ecosystem CO_2 exchange in pasture systems, but its short-term direct impacts on net ecosystem production (NEP) remain poorly quantified under real-world management conditions. Using eight years (2012-2019) of paddock-scale eddy covariance measurements from intensively managed dairy pastures in New Zealand, we quantified NEP responses to grazing, harvesting, and pugging. Across 168 grazing and/or harvest events, accumulated NEP ranged from −52 to 181 g C m^{-2} per event (median: 26 g C m^{-2}; mean: 30 g C m^{-2}). Average daily NEP in the 7 days before grazing (1.5 ± 0.4 g C m^{-2} d^{-1}) was significantly higher ($p < 0.05$) than in the 7 days after grazing (−0.6 ± 0.3 g C m^{-2} d^{-1}). Grazing-induced NEP reductions (pre- vs. post-grazing difference) varied seasonally (1-3 g C m^{-2} d^{-1}), with the greatest losses during mid-spring to early summer (October-December), when pre-grazing carbon (C) uptake potential was highest. From late winter to mid spring (August-October), NEP accumulation between grazing events exceeded the C removed in harvested biomass, suggesting that the additional fixed C was likely allocated to belowground pools or unharvested residuals. October emerged as a critical month, combining high C uptake with strong sensitivity to grazing timing. Limited case comparisons (n = 3 each) indicated that spring harvesting sometimes supported faster short-term NEP recovery than grazing, while winter pugging consistently suppressed NEP. These findings highlight the importance of aligning pasture management with seasonal C dynamics and suggest that even small adjustments in grazing timing may enhance CO_2 uptake and contribute to climate-resilient pasture systems.

Wigley K, Brambilla G, Elleouet J, Wakelin SJ, Clough TJ Wakelin SA, 2025. Methane uptake in New Zealand planted forest soils. Soil Research, 63(7). SR25011.

Context New Zealand's 1.6 million ha of *Pinus radiata* represent a potentially substantial but unaccounted for methane (CH_4) sink in the nation's greenhouse gas inventory. Quantifying this sink is crucial as it offers an opportunity to offset emissions from agriculture and other sectors. Aim To obtain the first *in-situ* data on CH_4 fluxes in *P. radiata* forests across New Zealand and to evaluate the implications for the country's CH_4 budget.
Methods Monthly CH_4 flux measurements were collected over a 12-month period at three forest sites: Kaingaroa, McLeans Island, and Orton Bradley Park.
Key results All sites were CH_4 sinks, with average uptakes of 2.8 kg CH_4 ha^{-1} $year^{-1}$ at Kaingaroa, and 2.5 kg CH_4 ha^{-1} $year^{-1}$ at the other two sites. While fluxes varied spatially and temporally, no significant correlations were found between CH_4 flux and the measured environmental variables (soil water content, soil temperature, and relative gas diffusivity), possibly due to unmeasured within-site variability, low bulk density, and high gas diffusivity of the soils – meaning that gas diffusion was not limited, or insensitivity of CH_4 cycling over the temperature and moisture ranges present at the sites. Extrapolated nationally, *P. radiata* forests are estimated to absorb 113.6 kt CO_2-e of CH_4 annually.
Conclusions Scaled nationally, CH_4 oxidation in planted forest soils could offset a large proportion of emissions from sectors such as rail transport and natural gas production.
Implications This study shows that consideration should be made for incorporating this sink into New Zealand's greenhouse gas budgets along with other CH_4 sinks and sources in *P. radiata* forests to better inform climate change mitigation policies.

Sutharsan R, Jeyakumar P, Burkitt L, Matse DT, Dhanuskodi R, Hanly J, Donaghy DJ. Enhancing biological nitrogen fixation through diverse pasture swards. Plants. 2025; 14(17):2727. https://doi.org/10.3390/plants14172727

Regenerative agricultural practices emphasize the use of diverse pasture species within sustainable agriculture production systems. The inclusion of a range of legume species in diverse pasture swards is likely to increase biological N fixation (BNF) across seasons, reducing the system's reliance on synthetic N inputs. The present field study aims to quantify BNF in selected legume species within diverse pasture (combining 9 species) and standard pastures (ryegrass and clover combination) and assess their performance to identify the potential for improving N supply while maintaining year-round pasture quality. A year-round seasonal BNF was assessed by evaluating soil N status, nodulation patterns, plant composition, and conducting ^{15}N natural abundance studies. The results revealed that the diverse pasture sward produced 5.4% more dry matter compared to the standard pasture, while soil mineral N (NO_3^-, NH_4^+) remained statistically similar between the two treatments. Nitrogen yield was 9.3% higher in the diverse pasture than in the standard pasture. ^{15}N natural abundance analysis assessment revealed no substantial variation in BNF rates across treatments throughout the study. However, in contrast to standard pasture, the BNF rate in diverse pasture experienced a 3-fold increase from winter to summer, while the standard pasture exhibited a 1.5-fold increase. In both pasture systems, BNF increased with clover proportion up to 30%, indicating optimal fixation at moderate clover levels. The findings underscore the potential of diverse pastures when strategically managed to enhance seasonal BNF while sustaining pasture productivity.

Palihakkara J, Burkitt L, Jeyakumar P, Attanayake CP 2025. Phosphorus release under short-term submergence of pasture soils in critical source areas. Journal of Environmental Management 375: 124317. https://doi.org/10.1016/j.jenvman.2025.124317

Critical source areas (CSAs) can act as a source of phosphorus (P) in surface waters by releasing soil P to porewater during frequent rainfall events. The extent of P release under short-term, frequent submergence has not been systematically studied in CSAs in New Zealand. A study was conducted to explore the potential of three contrasting dairy and sheep/beef farm soils (Recent, Pallic and Allophanic soils) to release P to porewater and pondwater under short-term and frequent submergence. Five undisturbed soil blocks (20 × 20 × 15 cm) were sampled from each soil. Porewater samplers and half-cell platinum electrodes for in-situ redox potential measurements were installed at 2 and 10 cm depths from the soil surface. Six submerged events were created by maintaining a 5 cm waterhead. Porewater and pondwater samples were collected immediately and three days after each submergence event. After three days of submergence, the soil blocks were drained and maintained at 70% of water holding capacity for 10 days before the next submergence event. Dissolved reactive phosphorus (DRP), pH, dissolved organic carbon, cations, anions, and alkalinity of the water samples were measured. Soil chemical P fractions were assessed in initial soils and soils in the middle and end of the experiment. Thermodynamic modelling was used to infer dissolution and formation of P and P-associated minerals. The Recent soil released P to porewater at both depths and to pondwater. The Pallic soil released P to porewater at both depths but did not change pondwater DRP. Allophanic soil sorbed P and did not increase DRP either in porewater or pondwater. The average pondwater DRP of the three soils during submergence were 17 to 65-fold higher than the New Zealand lowland river target DRP concentration (0.01 mg/L). The mechanisms of P release from the Recent and Pallic soils were desorption and reductive dissolution of Mn(II) minerals. Reductive dissolution of Fe(II) minerals was not supported by fractionation or modelling results. Decreases in labile, moderately labile and stable P fractions contributed to P release in the Recent soil, while increases in the labile and moderately labile P fractions contributed to P retention in the Pallic and Allophanic soils. This study highlighted that the Recent soil is riskier than the other two soils in releasing P upon short-term submergence and the potential use of Allophanic soil as a P sorbing material in CSAs to mitigate P loss.

Palihakkara J, Burkitt L, Jeyakumar P, Attanayake CP 2025. Redox-induced phosphorus release from critical source areas following rainfall events in New Zealand. Journal of Environmental Management 374: 124006. https://doi.org/10.1016/j.jenvman.2024.124006

Critical source areas (CSAs) can act as a source of phosphorus (P) during intermittent rainfall events and contribute to dissolved P loss via runoff. Dissolved forms of P are readily accessible for plant and algal uptake; hence it is a concern in terms of the eutrophication of freshwater bodies. The potential of CSAs to release dissolved P to surface runoff upon intermittent short-term submergence caused by different rainfall events has not been studied at a field-scale in New Zealand previously. A field study was conducted to investigate the potential of two different pastoral soil CSAs (Recent and Pallic soil) to release soil P over five rainfall events during winter and to explore the mechanisms of P release in these soils. Ten sampling stations were installed within each CSA in an area of 6 × 2 m^2. Each sampling station had two porewater samplers installed at two depths (2 and 10 cm) below the soil surface. Two platinum half-cell electrodes were installed at the same two depths. Porewater and floodwater samples were collected following five rainfall events. Redox potentials were measured in-situ. Dissolved reactive phosphorus (DRP), pH, dissolved organic carbon, cations, anions, and alkalinity of the water samples were measured. Soil chemical P fractions were assessed at the beginning, middle and end of the experiment. Thermodynamic modelling was used to infer dissolution and formation of P and P-associated minerals. The average porewater DRP at the two depths during the rainfall events of the Recent and Pallic soils were 0.32-1.3 mg L^{-1} and 0.26-2.31 mg L^{-1}, respectively. The average floodwater DRP concentrations of the Recent and Pallic soils were 35 and 43-fold higher than the target DRP concentration (0.01 mg L−1) for the Manawatū River. The study highlights the substantial risk of P loss from CSAs to surface water, driven primarily by the reductive dissolution of Fe and Mn oxy(hydr)oxides. The findings underscore the importance of targeted management strategies to mitigate dissolved P runoff, particularly in high-risk CSAs frequent submerged during rainfall events. This study developed an effective method for monitoring soil porewater P and redox conditions, offering valuable insights and practical tools for resource managers seeking to reduce P contamination.

Journal of New Zealand Grasslands

The latest annual edition of Journal of New Zealand Grasslands is published.
DOI: https://doi.org/10.33584/jnzg.2025.87

The Journal of New Zealand Grasslands publishes peer-reviewed papers with a focus on temperate grassland research. The scope of the journal includes all aspects of pastoral research including agronomy, soils, animals, agricultural extension and farm-systems research. Below is a selection of soil, production, and environment articles, but there are more:

- Reflections on the past and links to the future
- An overview of the cost-effectiveness of nitrogen leaching mitigation strategies based on marginal abatement cost for eighteen dairy farms in Hauraki and Horizons regions
- Will wide-spaced silvo-pastoral plantings maintain soil carbon stocks?
- Changes in soil fertility, biology and organic carbon under contrasting phosphorus fertiliser and sheep grazing management
- Nutrient and contaminant profiles of soil, herbage and dung from sheep grazed pastures with varying phosphorus fertiliser histories
- Case studies of alternative wintering practices in sheep, beef and deer farming in Southern New Zealand
- Sheep liveweight and dry matter production from Year 3 of the Regenerative Agriculture Dryland Experiment

- Does wintering on diverse pastures or kale crop affect N loss risk? Findings from a case study of a commercial dairy farm in Methven

Quantifying the impact of grazing on ecosystem CO_2 exchange in intensively managed pastures. https://doi.org/10.1016/j.agee.2025.110052

Grazing alters ecosystem CO_2 exchange in pasture systems, but its short-term direct impacts on net ecosystem production (NEP) remain poorly quantified under real-world management conditions. Using eight years (2012-2019) of paddock-scale eddy covariance measurements from intensively managed dairy pastures in New Zealand, we quantified NEP responses to grazing, harvesting, and pugging. Across 168 grazing and/or harvest events, accumulated NEP ranged from −52 to 181 g C m^{-2} per event (median: 26 g C m^{-2}; mean: 30 g C m^{-2}). Average daily NEP in the 7 days before grazing (1.5 ± 0.4 g C m^{-2} d^{-1}) was significantly higher ($p < 0.05$) than in the 7 days after grazing (−0.6 ± 0.3 g C m^{-2} d^{-1}). Grazing-induced NEP reductions (pre- vs. post-grazing difference) varied seasonally (1-3 g C m^{-2} d^{-1}), with the greatest losses during mid-spring to early summer (October-December), when pre-grazing carbon (C) uptake potential was highest. From late winter to mid spring (August-October), NEP accumulation between grazing events exceeded the C removed in harvested biomass, suggesting that the additional fixed C was likely allocated to belowground pools or unharvested residuals. October emerged as a critical month, combining high C uptake with strong sensitivity to grazing timing. Limited case comparisons (n = 3 each) indicated that spring harvesting sometimes supported faster short-term NEP recovery than grazing, while winter pugging consistently suppressed NEP. These findings highlight the importance of aligning pasture management with seasonal C dynamics and suggest that even small adjustments in grazing timing may enhance CO_2 uptake and contribute to climate-resilient pasture systems.

Periodic cropping of pasture for summer-grazed turnips leads to substantial carbon loss. https://doi.org/10.1016/j.agrformet.2025.110803

Understanding how management practices impact carbon (C) cycling in agroecosystems is critical from the perspective of greenhouse gas emissions and to ensure ongoing soil quality, production and profitability of the land. Here, we quantified the net ecosystem C balance (NECB) of two grazed summer turnip crops grown as part of the pasture renewal process – a common management practice of New Zealand dairy grasslands. The NECB was calculated from measurements of net ecosystem production obtained using eddy covariance and measurements or estimates of all other major flows of C into and out of two adjacent paddocks. The NECB of the two turnip crop periods (~7 months in length) indicated C losses of −539 and −596 g C m^{-2} $period^{-1}$. Carbon was also lost from the adjacent pasture paddock during both crop periods, thus reducing the net effect (i.e., turnips minus pasture) of the periodic cropping of grazed turnips to −441 and −413 g C m^{-2} $period^{-1}$. Returns of C during grazing via grazing wastage and excreta deposition offset some of the C lost from ecosystem respiration during the long periods with no or limited photosynthesis partly reducing total C loss. Soil C stocks were also measured via direct soil sampling to 0.6 m before and after the turnip crops. However, high spatial variability of direct soil sampling prevented corroboration of the C loss calculated by the NECB. The NECB approach was able to detect much smaller changes in carbon than practical soil sampling approaches allowed. We concluded that the production of grazed turnips for supplemental feed as part of the pasture renewal process resulted in significant C loss that must be recaptured under a return to pasture before further cropping to avoid a downward staircase of C stocks in these agroecosystems.

Deadline....... for the next issue of Soil News is 16 February

We are the New Zealand Soil News:
Editor: **John Drewry** – drewryj@landcareresearch.co.nz
Correspondents: **Thomas Caspari,** Bioeconomy Science Institute - Manaaki Whenua-Landcare Research (Lincoln); **Josie Mazzetto,** Lincoln University; **Callum Rees**, Massey University; **John Drewry**, Bioeconomy Science Institute - Manaaki Whenua - Landcare Research (Palmerston North); **Suzanne Lambie**, Bioeconomy Science Institute - Manaaki Whenua - Landcare Research (Hamilton); **Vitor de Jesus Martins Bianchini**, Waikato University; **Matt Taylor**, Waikato Regional Council (Hamilton); **Nicole Schon**, Bioeconomy Science Institute - AgResearch (Lincoln); **Juliet Clague**, Lincoln Agritech (Hamilton); **Richard Gillespie**, Bioeconomy Science Institute - Plant & Food (Lincoln); **Natalie Bartlett**, Bioeconomy Science Institute - AgResearch (Hamilton); **Matt Norris**, Bioeconomy Science Institute - Plant & Food (Ruakura); **Jen Owens**, Bioeconomy Science Institute - Scion