Welcome to the Soil News

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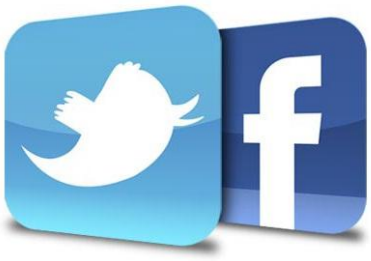
Your contributions are required - New Zealand Soil News is your newsletter

Balin Robertson
Bioeconomy Science Institute
74 Gerald Street
Lincoln 7608
email:
robertsonb@landcareresearch.co.nz



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From the Editor

Welcome to this issue of Soil News.

We have some truly great submissions this edition, and we welcome the first correspondence from John Drewry from Environment Southland.

Only three weeks until the SOIL ŌTAUTAHI 2026 conference, which is sure to be a great experience and is also the driver of my next poem below.

I invite contributions for future editions of Soil News. Submissions may be entered anonymously and can include soil- or research-related poems, art, photographs (with a short caption if possible), cartoons/illustrations, and jokes.
Please send to robertsonb@landcareresearch.co.nz

Plenty of Time

A month until the conference; still plenty of time.
I'll craft the perfect talk; it will be sublime.

This time my focus won't go astray,
But first, a few tasks to get out of the way.

Then one more thing, and perhaps another.
Time flies by, and that's when I discover,

That only one day remains, oh dear!
Well, diamonds are made under pressure, I hear.

Disclaimer: any opinions expressed are those of the writer only.

Inaugural special issue: New Zealand Journal of Agricultural Research (NZJAR)



The Royal Society Te Apārangi, through the New Zealand Journal of Agricultural Research (NZJAR), has announced a new collaboration with the New Zealand Society of Soil Science (NZSSS) to produce a special journal issue associated with the SOIL ŌTAUTAHI 2026 conference.

This is an opportunity for researchers presenting at the conference to take their work beyond the conference and contribute to a dedicated publication showcasing contemporary soil science research from Aotearoa New Zealand. It provides a formal link between the NZSSS biennial conference and peer-reviewed publication, and is intended to become a recurring feature of the NZSSS biennial conference.

We welcome full-length research articles and review papers showcasing advances across soil science, including soil health, biodiversity, nutrient cycling, soil carbon, climate resilience, sustainable land management, and any other subjects relating to our 2026 conference theme *Building Resilient Futures for Soils*.

Special issue at a glance

Journal	New Zealand Journal of Agricultural Research
Publisher	Royal Society Te Apārangi, in partnership with Wiley
Partner organisation	New Zealand Society of Soil Science
Associated conference	SOIL ŌTAUTAHI 2026 (30 Nov–3 Dec 2026)
Manuscript deadline	31 March 2027
Publication type	Full-length research articles and review articles
Peer review	Standard journal peer-review process

Guest Editors

Kirstin Deuss (Lead Guest Editor), Bioeconomy Science Institute

deussk@landcareresearch.co.nz

Carol Smith, Lincoln University

Carol.Smith@lincoln.ac.nz

Brendon Malcolm, Bioeconomy Science Institute

brendon.malcolm@plantandfood.co.nz

Jim Moir, Lincoln University

Jim.moir@lincoln.ac.nz

Key dates

Submission site opens: OPEN NOW

Manuscript submission deadline: 31 March 2027

When submitting, authors should select “NZSSS Conference” from the Special Issue drop-down menu.

Open Access and publication options

- Authors affiliated with any of New Zealand's eight universities, the Bioeconomy Science Institute (BSI) or Earth Sciences New Zealand (ESNZ) may be eligible to publish Open Access in NZJAR free of charge through the CAUL/Wiley agreements.
- Authors who are not affiliated with one of the participating institutions can publish through the journal's traditional subscription model at no publication charge.

Submission information

Submit your manuscript
https://authors.wiley.com/dashboard/journal?groupCode=JAG2
Author guidelines
https://rsnz.onlinelibrary.wiley.com/hub/journal/11758775/author-guidelines

Researchers interested in contributing to the Special Issue are encouraged to develop their conference presentations into full-length manuscripts for consideration in the Special Issue. Manuscripts must be submitted by 31 March 2027.

For enquiries about the Special Issue, please contact the Lead Guest Editor Dr Kirstin Deuss at deussk@landcareresearch.co.nz or Fei He, Head of Publishing, Royal Society Te Apārangi, at Fei.He@royalsociety.org.nz.

Things that interested me

From Matthew Taylor

Disclaimer: any opinions expressed are those of the writer only.

An Ignoble achievement

In 2021, Swiss soil scientist Franz Bender and his team recruited 1,000 citizen scientists to bury and later dig up underwear around Switzerland to study soil and soil health. In September this year, the research won an Ig Nobel Prize, which is awarded annually for research that makes people laugh and then think.

I was able to put some questions to Franz via email.

Could you comment on the challenges and successes you found?

"First of all, we were surprised how quickly the 1000 spots for participation filled up. I think the idea of burying underpants sounded appealing to many. We also offered a free soil lab analysis for every participant together with additional information on how to interpret the results and recommendations on how to improve their soil, if needed.

Also, the return rate, i.e. the number of underpants and soil samples shipped back to the lab by the citizen scientists, were very high- about 80%.

The biggest challenge was then to first analyze almost 900 soil samples and finding out how to quantify underpants decomposition in a reliable way and weighing more than 7000 tea bags. The lab analyses took us more than a year. We also collected detailed background information on land use and management of the investigated sites from the participants. We ended up with a very complicated data set with lots of NA values.

It was a very work intensive but also rewarding experience".

Did you achieve representation of the broader society or were certain groups more receptive?

"We aimed for 500 farmers participating. Many of them were already farming regeneratively, but many were also very conventional farms.

For the broader society, it is hard to tell, since we don't have a lot of personal information about the participants".

How did you manage soils with disruptive managements, e.g. In my experience, soil strips must be removed from cropping land before ploughing?

"We planned the timing so that the underpants could go in the soil after the last management operation in spring and could be retrieved before harvest"?

Did you measure the engagement response from the Public; if so, how?

"We received a lot of little notes and feedback from participants, thanking us for the great experience. Many that we met personally told us that they benefited from the project. Especially, the detailed explanations of the soil analyses were appreciated by many. But these are selective responses. What we can say is that the project received a lot of media attention globally".

What is the most salient advice you can give to soil scientists in New Zealand regarding engaging the wider community in soil science?

"I think it is important to create experiences of soil with all senses, e.g. by trying to make soil processes visible and connect them to other areas of peoples' realities, e.g. through art. There is also a project called Sounding Soil in Switzerland, where people can rent special microphones enabling them to hear the sounds soil organisms make in their soils. Such approaches are extremely valuable to engage people and put their focus on the amazingly diverse world beneath our feet".

Naturally, we will refer to your Plants, People, Planet publication, Science letter, and include links. Are there any other publications relating to this work we should include? Anything else you would like us to highlight?

"So far, this is all we have published. Right now, we are collaborating with a fashion designer on a project where we look at the connection between soils and fashion. Participants bury old garments made of different fibres and observe how they decompose, or not. From the decomposed garment, a big artwork will be created. **Participation is possible worldwide until March 2027**.

More info here:
https://aus01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.edielous tudio.com%2Fsoil-bodies&data=05%7C02%7CMatthew.Taylor%40waikatoregion.govt.nz%7C1e2eb937119b43060b3108df13d79575%7Ce36ab77fcb694ec4bf31a94b8dacc5ca%7C0%7C0%7C639251488868963770%7CUnknown%7CTWFpbGZsb3d8eyJFbXB0eU1hcGkiOnRydWUsIlYiOiIwLjAuMDAwMCIsIlAiOiJXaW4zMiIsIkFOIjoiTWFpbCIsIldUIjoyfQ%3D%3D%7C0%7C%7C%7C&sdata=J7mnyTB7qVOlfrjeZDFuVggoSGRl4EV%2FyElm%2Bi%2BEANE%3D&reserved=0

She also created a rococo dress from the decomposed underpants to put soil in the spotlight".

Thanks for your time, Franz, and I wish you every success in your future endeavours.

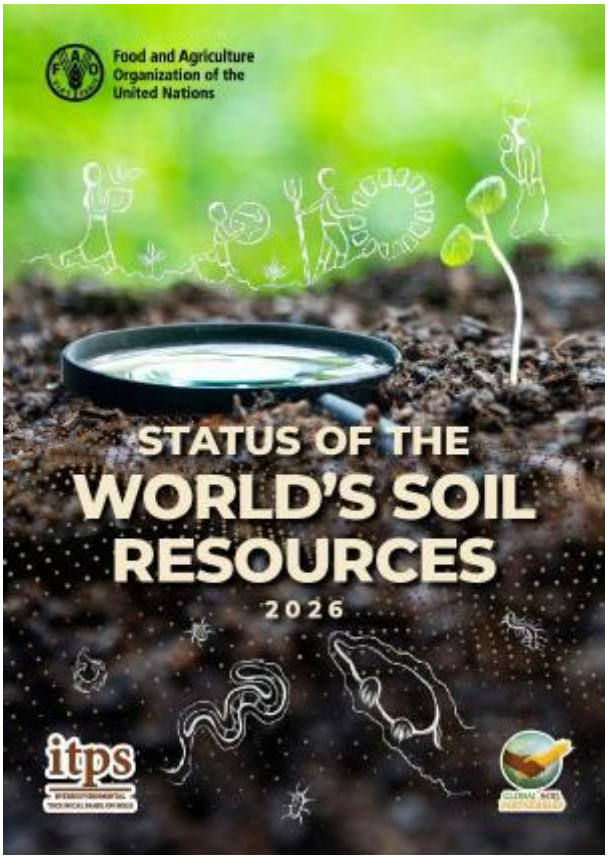
Links to an article and the research paper are below:

Assessing soil health with underpants
https://www.science.org/doi/full/10.1126/science.adw0030

Bender, S.F., Bürge, D., Bragazza, L., Knop, E., Masson, S., Peter, N., Demarmels, R., Mueller, D., Imhof, A., Viviani, P. and Bieri, A., 2026. Soil health assessment using buried cotton underpants with the help of 1000 citizen scientists. *Plants, People, Planet*. Soil health assessment using buried cotton underpants with the help of 1000 citizen scientists

Dr Franz Bender is Team Leader Agroecological assessments at Agroscope. Agroscope is Switzerland's federal center of excellence for agricultural research and focuses on research that supports sustainable agriculture, high-quality food production, and environmental protection.

Status of the World's Soil Resources is now released!



The Status of the World's Soil Resources 2026 provides an updated global assessment of the status of and trends in the adoption of sustainable soil management of the world's soils. Prepared by the scientific advisory body of the FAO Global Soil Partnership (GSP), the Intergovernmental Technical Panel on Soils (ITPS), the assessment brings together scientific evidence and regional expertise from around the world, including from Aotearoa New Zealand.

Status of the World's Soil Resources | Global Soil Partnership | FAO

New output from Soil Health Benchmarks

Our latest publication presents a complete workflow for processing multilingual stakeholder workshop data, from collection all the way to interactive dissemination. It draws on real workshops across 22 European case study sites and more than 500 participants.

The results also highlight the importance of local context. For example, while climate change, soil compaction and financial pressure were strong concerns in both Austria and the Netherlands, waste management, soil sealing and erosion were much more prominent in the Austrian workshop.

The paper also documents the methodology behind our Stakeholder Insights Explorer (SIX), the interactive tool which lets you compare workshop outcomes region by region. https://lnkd.in/giSK7Bw8

See how soil health is understood by stakeholders from different regions, land-uses or backgrounds at Benchmarks Workshops Interactive Tool

Book review: Secrets from the Antarctic Dry Valleys

Secrets from the Antarctic Dry Valleys, by Iain B. Campbell, published by the author and printed by The CopyPress (Nelson), 2026 (1st ed), 132 pp., 297 mm x 210 mm, NZD $58.00 (paperback), ISBN 9780473791933

Available from RealNZBooks (online bookshop for The CopyPress) (NZ$58.00 plus postage)
or available from the author at ibcinnz@gmail.com (NZ$50 plus postage) or from Fishpond (NZ$66.00 including postage except for rural delivery). Libraries can order through Wheelers.

Reviewed by
David J. Lowe
Emeritus professor
School of Science-Te Aka Mātuatua,
University of Waikato, Private Bag 3105, Hamilton, 3240
david.lowe@waikato.ac.nz

Disclaimer: any opinions expressed are those of the writer only.



When I began my undergraduate studies in the Department of Earth Sciences (DESc) more than 50 years ago at the University of Waikato (UoW) in Hamilton in 1972, I soon became aware of the fledgling department's commitment to research in the so-called McMurdo Dry Valleys in Victoria Land, Ross Dependency, Antarctica. In fact, the first UoW expedition to the Dry Valleys (involving Prof. Alex Wilson, Michael Selby, Dr Chris Hendy, and Jim Johnston) had taken place in the summer season of 1969–70, only a few months before the School of Science (including DESc) first opened its doors to undergraduates in early 1970. Located west of McMurdo Sound and nearly 5,000 km^2 in area, the Dry Valleys comprise the largest semi-continuous ice-free area of the continent. Made up of three main valleys, Taylor, Wright, and Victoria (and numerous smaller secondary valleys), the formerly fully-glaciated valleys, 40–60 km long, extend approximately eastward from the Polar Plateau nearly to the coast. The absence of large glaciers and the extremely arid environment are the result of very low precipitation which is manifest mainly as snow, itself easily removed by sublimation via strong, dry katabatic winds, together with minor liquid water (including that of the ephemeral meltwater stream, the Onyx River) during brief summer thaws. Captain Robert Scott, William Lashly, and Edgar Evans were the first to set eyes on the Dry Valley system on 18 December, 1903, during the "Western Journey" of the 1901–04 National Antarctic (*Discovery*) Expedition (Harrowfield, 2007).

Photographs of the Dry Valleys from the early UoW trips peppered our early lectures and new, well-illustrated books, such as that of McPherson (1975), fired the imagination even further. At the same time, we learnt of the two-month-long adventurous geological mapping expedition by two young geologists, Barrie McKelvey and Peter Webb of Victoria University of Wellington (VuW), in the Dry Valleys during the summer of 1958–59. The fieldwork was for their masterate degrees. McKelvey and Webb were accompanied by geophysicist Dr Colin Bull (expedition leader) and zoologist Dick Barwick, with the former writing a commemorative account of the 1958–59 VuW expedition 50 years later (Bull, 2009). In addition, as New Zealanders, we were well aware and proud of the Commonwealth Trans-Antarctic Expedition (1955–58) that included Sir Edmund Hillary leading the New Zealand Ross Sea support party to the South Pole on 4 January, 1958, the first overland group to attain that goal since Scott's ill-fated party in 1912. In reviewing Bull's (2009) book, Wearing (2010, p. 177) quite correctly noted that "The Antarctic has exerted a strong hold on the minds of many people, and books have helped to satiate enthusiasm for it." These words and that "strong hold" would certainly have resonated with me in my formative geoscience years of the 1970s.

Consequently, the possibility of seeing the Dry Valleys for myself as part of a four-person UoW expedition, led by Prof. Michael Selby in the 1978–89 season, was scheduled to realise my long-desired ambition. However, after mapping in the Darwin Glacier-Britannia Range region, our plan to finish off with a two-week trip to the "tropical" Dry Valleys was thwarted by a helicopter crash near Darwin (Glacier) base camp, which meant that helicopter support was no longer sufficient to sustain our Dry Valleys trip, which was cancelled.

So, knowing I would never see the Dry Valleys in person, it was a pleasure to receive a copy of Dr Iain Campbell's new book "Secrets from the Antarctic Dry Valleys" in July this year. Campbell is a Quaternary environmental scientist and soil scientist. A pioneering Antarctic explorer, he first visited the Ross Sea region and the inland Dry Valleys area in the 1964–65 summer (Fig. 1) with colleague Dr Graeme Claridge (soil chemist/clay mineralogist) (Fig. 2). Eventually covering large parts of the Transantarctic Mountains, Campbell made 17 Antarctic expeditions over a 35-year period with an increasing focus on the Dry Valleys. (Such an achievement is itself worthy of acclaim. Carrying out fieldwork in Antarctic, involving 20-hour-long days at times, is no picnic.)



Figure 1. Iain Campbell in Barwick Valley near Lake Vaska (Dry Valleys area) in early 1965 during his first trip to Antarctica in the epic 1964–65 field season. Photo: G. Claridge.



Figure 2. Iain Campbell (left) with Graeme Claridge after working through the night on the Insel Range (which is southwest of Victoria Valley) in the Dry Valleys, in early 1965. Photo: time-lapse by I. Campbell.

I first met Campbell (with Claridge) fleetingly on around 17 November 1978 at Darwin base camp, the pair having just returned, I vividly recall, frigid with cold and heavily bedecked with ice, from a stint of soil description and sampling in the elevated Banna Ridge area and Abus Valley (of the northern Britannia Range) near the head of the Hatherton Glacier. Over the 1990–99 decade, Campbell worked in the Dry Valleys studying permafrost and human environmental impacts. He was awarded the Polar Medal in 1991 and is the author of over 90 Antarctic publications including a highly regarded book (Campbell and Claridge, 1987).

Campbell is to be commended for devising, writing, and publishing this new book on the Dry Valleys. He expertly describes and illustrates a wide range of processes and landscapes in the area, including land surfaces and rocks shaped by wind, Mars-like landscapes, salty and ancient soils, and, more recently, some impacts from human activity. According to Campbell, the many unique features of the Dry Valleys primarily relate to the area's long and complex glacial history, and the extraordinary age and undisturbed nature of the land surfaces, which, with the severe cold and aridity, slows down all natural processes.

Laid out in landscape format and A4 in size with soft covers, the book is divided into 11 sections of varying lengths as follows:

Introduction (3 pages)

The Dry Valleys system (22 pages)

The age of landforms (11 pages)

Dry Valley soils – legacies from the past (7 pages)

Water in the Dry Valleys (12 pages)

How Antarctic rocks come apart (24 pages)

Patterned ground (18 pages)

Salts in an arid landscape (8 pages)

Wind – how it shapes everything (10 pages)

The living things (8 pages)

The human footprint (11 pages)

Each of these topics is covered with good quality photographs, many full-page in size, attractively laid out with short captions amidst blocks of succinct, informative, and up-to-date text. More than 220 photographs are presented in total. They consist of a mix of wide angle vistas (such as ranges and valleys, alpine glaciers frozen in place, the enigmatic Labyrinth, a multi-armed box-canyon-like landform, and the rarely flowing Onyx River – the only river on the continent), mid-range views of landscape features (such as a piedmont glacier terminus and saline and frozen lakes), and closer (or close-up) views of many distinctive features including aeolian attributes (ventifacts), cavernous weathering, patterned ground, sand dunes, profiles of soils up to 10 million years old, chemically-pitted rocks, desert varnish, lag gravels, shattered rocks, a mummified seal, endolithic algae, and the long-lived imprints of human activities dating back to halcyon days of the 1950–60s pioneering expeditions.

Does the book meet its aim and reveal the secrets and drama of the Dry Valleys? I think so: it is a very well written, extensively illustrated, masterly compilation of a wide range of topics about the region and its special place in the history of Antarctic research. It is not a text book but instead is an authoritative “coffee table” book with just enough to-the-point textual information to introduce a reader to the many topics covered. Either it can be read more-or-less right through in one sitting, as I did, or dipped into chapter by chapter. In full colour and well produced, the book’s price is very reasonable in these straightened times. Anyone with an interest in Antarctica – and especially if it has a “a strong hold on the mind” – should buy a copy to help satiate one’s enthusiasm for it.

Further information about soil-related research in Antarctica, along with some historic records, an interview with Campbell together with scanned copies of all his field notes over the years, is available at Antarctic Soils Explorer

(https://antarctic-soils.landcareresearch.co.nz/).

References

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Correspondence from the Land Monitoring Forum (LMF)

From Matthew Taylor (LMF Correspondent)

The Land Monitoring Forum (LMF) is a Te Uru Kahika Special Interest Group (SIG) that facilitates the interaction and collaboration of council staff whose work relates to the broad field of soil and land resources science and policy.

The purpose of the LMF is to: “Improve the management and monitoring of soil and land resources throughout New Zealand by sharing and coordinating soil and land science and policy information between regional and unitary councils, and with other organisations where appropriate (e.g. Ministry for Cities, Environment, Regions and Transport (MCERT), Stats NZ, and research organisations).”

The LMF is focused on the provision of robust science-based information needed to support sustainable soil and land resource management. Work involves the development, improvement, and reporting of state of the environment indicators, monitoring and modelling approaches, and resource inventory information on:

- soil quality and trace elements,
- highly productive land,
- soil stability/erosion,
- suspended sediment,
- land fragmentation, and
- land cover/use, etc.

Haydon Jones (Waikato Regional Council) is the current Convenor of the Land Monitoring Forum. Council representatives in the LMF are predominantly staff in soil and land science/monitoring roles, or in more applied land management roles.

The LMF normally holds two full meetings per year (at around six-monthly intervals, with one being a hybrid face-to-face/online meeting, the other online only) and two quarterly catch-up meetings held online in the intervals between the full meetings. The most recent (full) meeting was held on 5-6 November 2026 in Wellington.

Updates at the November meeting were received from the LMF convenor, Haydon Jones, and from the Resource Managers Group (RMG; the lead SIG that the LMF reports to) link to the LMF, Abby Matthews. In addition, the Chief Science Advisor for Te Uru Kahika (the Regional and Unitary Councils of Aotearoa), Chris Daughney, gave updates on matters relating to science in the regional sector.

Updates were also received from MCERT (Fiona Curran-Cournane, Deb Burgess, and Marijke Ransom), Stats NZ (David Harris), MPI (Kathleen Wong and Gustav Chu-Ling), and the Office of the PCE (Anna Hooper). One item discussed that might be of interest to the wider soil science community is the PCE's report, *Unlocking environmental information* report (July 2026):

- Chapter 3 describes a federated data system (and builds on the 2025 publication titled *A federated system to improve environmental information*),
- Chapters 4 to 7 talk about some of the novel technologies (including remote sensing, place-based monitoring innovations, AI and machine learning),
- Chapter 8 puts a spotlight on several catchments and available environmental information for those catchments,
- Chapter 9 answers a question as to whether Budget 2026 has solved the problem, and
- Chapter 10 contains recommendations.

Another session on the first day of the meeting was devoted to sediment and erosion projects with presentations from Andrew Neverman (BSI), Simon Vale (BSI), Kurt Barichievy (Hawke's Bay Regional Council), and Tim Norris (Waikato Regional Council). Topics included LiDAR-based SedNetNZ modelling for land and water management, assessing streambank erosion and riparian characteristics, and an example of catchment-scale SedNetNZ modelling.

During the second day, Sam Carrick (BSI) provided an update on land and soil research at BSI, while Matthew Taylor (Waikato Regional Council) presented on soil biodiversity indicator development, an update on the biodiversity working group, and an example of implementation of the new soil quality reference ranges.

Additionally, Haydon Jones presented on the development of an LMF Work Plan in-line with the Research Roadmap for the LMF and Land Managers Group SIG (LMG).

A Research Roadmap for Land and Soil - 2026-2036.

The Listener Gets Soil

By Jock Churchman.

Disclaimer: any opinions expressed are those of the writer only.

I have no doubt that the *New Zealand Listener* is one of the icons of Aotearoa/New Zealand. As a wide-ranging well-written weekly magazine, it has no equivalent in Australia and I found years ago that *The Listener* in the UK (which ceased publication in 1991) was much narrower in scope as a magazine that specialised in reviews of mainly radio programmes. I see the *NZ Listener* weekly on-line and look forward to each new issue.

Recently, the magazine served up a great surprise for this retired soil scientist and no doubt also for others from our profession. One of their regular writers, Michele Hewitson, who more often interviews people from the literary world, actually wrote about soils, resulting in "What's bugging Dr Worm"[1] and it was an excellent article.

Clearly, Michele Hewitson was charmed by soil and especially worms, through her introduction to Frank Ashwood, alias Dr Worm. She was also charmed by Frank Ashwood, who comes with a very interesting story and attitude.

Its critters provide a good and popular entry into the topic of soils. *New Zealand Soil News*, also a noteworthy publication of its type (I note that Australia no longer has an equivalent) ran a regular feature in the 70s and 80s by Polly McColl, in which she introduced a new soil critter to readers each issue. It was always informative and well-written and illustrated.

The Hewitson Profile on Dr Worm and soils had me thinking about my own 40+ year career in soils. I entered soil science via Otago science degrees in chemistry, indeed physical inorganic chemistry. This was a common route for laboratory-based soil scientists at the time (the 1970s), although not all trained at Otago! Of course, there was a large intake of people with degrees in geology, who crossed over into soil studies in the field. And there were specialist biologists who studied appropriate niches. There were also physicists and mathematicians.

My career in soil science involved an intellectual progression. I tended to hang around the X-ray diffractometer and other instruments like the infra-red spectrometer and differential thermal analysis at least for a few years and so produced results and stories about the inorganic mineral components of soils, which we characterised as their backbone. I was in my comfort zone there (Fig.1). But I was fortunate to rub shoulders and share ideas with colleagues who came from other backgrounds. It was probably a unique time of generous funding for science and, in institutions like the NZ Soil Bureau, we were encouraged to share our insights on soils with people who came into soils through other scientific portals (Fig. 2).



Figure 1. The members (with an Australian visitor) of the Physical Chemistry and Mineralogy section at the Soil Bureau in the late 1970s.



Figure 2. Soil scientists from the Soil Bureau and elsewhere on a field trip during the NZ Society of Soil Science Conference in Nelson in 1988.

Actually, soil science was thought to be worthwhile at the highest levels of the land. I well remember Robert Muldoon, hardly my favourite NZ politician, laying out in his usual forthright manner what it was that should be studied in the country and what definitely shouldn't. The main point he was making was that this nation had no need for nuclear physics or its study, but that soil science was ideal as a profession and study within New Zealand.

The interactions with others with different skills and interests often led to joint projects, giving us each the chance to expand our view of soils. My main interactions were with Kevin Tate, with an organic chemistry background, and Benny Theng, with his encyclopaedic knowledge of soils and especially interactions between minerals and organic matter.

I had no idea about organic matter and had stopped learning organic chemistry early in my chemistry degree course, partly because it was presented unimaginatively, unlike inorganic chemistry, but that was just a function of who taught the topics in each case. Significantly, however, soil organic matter is a product of soil biology, its activity and its breakdown after death. I benefitted from learning something about it.

Eventually I wound up in Australia, after some short-term soil adventures in both the US and UK. It was now the era of needing funds to carry out well laid-out projects. There had to be collaboration between different specialists. One of the best initiatives during my Australian soil science career was the development of Cooperative Research Centres which brought together scientists from Government Research Centres, where I was, Universities and "industry". The Soils CRC was one of the first and it worked pretty well. Industry in its case was agriculture, represented by scientists concerned with production, which in our case in South Australia, was mainly of crops.

Later, I spent time in University departments and institutes, in both soil science and the environment. My outlook on soils had necessarily widened. Quite late in my career, reflecting on what I had been doing for those 40 years led me to studies in philosophy, resulting in a 2005 thesis[2] that tried to define soil science as a scientific discipline. There is a paper In Geoderma[3] that summarises the findings of the thesis.

I concluded, and continue to hold, that the essence of soils is biological. While there are chemical and physical, also engineering, aspects of soils, it is their biology and its effects that make soils unique. In particular, soils develop in vertical layers ("horizons"), their constituents occur together in lumps ("aggregates") – these give soils a structure, and their ultimate constituents are unique, not occurring anywhere else in nature.

This finding was a long way removed from the impression I had on first entering into soil studies. I followed Maurice Fieldes, my PhD examiner, Director of the Soil Bureau, DSIR, and the reason why I got a job at the Soil Bureau (believe it or not, you could get a job that wasn't even advertised in those days – the days when New Zealand had absolutely zero unemployment, reflected also in scientific research; though it helped to know the right people). Fieldes, who died before I took up the job, had published, among other things, a classification of NZ soils based on their clay mineral composition; this reflected a common inorganic view of soils at that time, the living components were simply inhabitants of the framework established by the inorganic minerals.

It is the biology that mainly gives soils their charm, of the type that captivated Michele Hewitson of the *Listener.* She records that 'Dr Worm' sees poetry in soils. He has written a book "The World Beneath Our Feet: The Hidden Life of Soil and Why it Matters to Us All" (I have not seen the book, but I look forward to doing so). He

describes it as a love letter to soil and tells us, through Hewitson “I love its (soil’s) mystery. I suppose that it guards its secrets very closely, and it takes quite a lot of effort to draw them out”.

My own passion, post-retirement, has been reading and writing and in other ways, working for more action on combatting, or, more realistically, slowing down global heating giving rise to climate change.

George Monbiot, who I have written about previously in *Soil News*[4] has long been an absolute warrior on climate change. He operates as a journalist, and often has pieces in *The Guardian.* It is less well-known that he has a degree in zoology from Oxford and he has a particularly strong affection for soils. in his book *Regenesis* (2022)[5], he becomes quite poetic about them, describing soil as “an immeasurably intricate, endlessly ramifying catacomb, created by bacteria, plants and microbes working unconsciously together”.

He goes on to make further points about soils, their genesis, resilience, and also breakdown. Thus:

Microbes create aggregates by sticking tiny particles together with the carbon-based polymers, or cements they excrete. Thus, they stabilise the soil and assemble habitats for themselves. They are like a wasps’ nest or beaver’s dam.

They are built on the principal of fractal scaling, so consistent, regardless of magnification used.

The self-organised, adaptive world that microbes, plants and animals build give structural resilience of soil in the face of droughts and floods.

But it can break down when farmed. When nitrogen fertiliser is applied, the microbes respond by burning through the carbon in the soil, much of which is stored in the polymers that build the catacombs. Without cement the structure begins to disintegrate. The pores cave in. Oxygen and water can no longer permeate. Paradoxically, plant roots in over-fertilised soils can struggle to reach the nutrients they need.

The latter point is highly relevant to New Zealand. The over-use of synthetic nitrogen fertilisers, accelerator of the country’s wealth from dairying, can degrade soils.

Mike Joy, a warrior for water quality in New Zealand, has long agitated about the effect of over-use of these nitrogen fertilisers on water. A co-authored paper of his, cited in his book *The Fight for Freshwater* (2024)[6] summed up the problem as “the greatest negative impact on river water quality in New Zealand has been high-producing pastures that require large amounts of fertiliser to support high densities of livestock”. The conclusion has to be that excessive use of nitrogen fertilisers will degrade soils, essentially turning them into dirt, so that they easily transmit the nitrogen, as nitrates, into water that runs off into rivers, lakes and drinking water reservoirs”. Besides water quality, the effects can include colon cancer[6].

Of course, soils are useful as the template and the source of nutrients for plant growth, so they provide the sustenance of most life on Earth. They are often also the key when it comes to dealing with climate change. They contain carbon and can

sequester it, with qualifications[7]. It is reasonable to ask why the ideal of soils, as described particularly well by Monbiot, matters when all you want to use them for is to grow crops for our food or grass to raise animals to provide us with food, including milk and dairy products.

The productivity that we demand from soils challenges their capacity to cope and to be sustained not only in New Zealand, but more dramatically, in the whole world. In 2014, Ed Landa from the US and I co-opted thoughtful experts in different aspects of soils from around the world to contribute to the book *The Soil Underfoot*[8] which had the overall aim of assessing the capacity of the world's soils to feed all the world's people. Even at that stage, this was not being achieved and reviews of future requirements proclaimed that "the world must produce 50% more food, on less land, with less fresh water, using less energy, fertiliser and pesticide – by 2030 (which is frighteningly soon) to sustain everyone on earth"[9, 10]. Stated simply, that is about as tall an order that is imaginable.

The Soil Underfoot did not arrive at a simple answer on the capacity of soils to sustain us all while being sustained themselves for future food security challenges. The last word was given by a very well-known soil scientist, Garrison Sposito, in the book's last chapter "Sustaining 'The Genius of Soils'"[10]. According to Sposito's well-researched chapter, there is little or no new land available for cultivation, nor is there more water flowing in streams and rivers, stored in lakes and reservoirs or pumped from groundwater available for expansion of irrigation. These sources of water are described as "blue water". Clearly, water is vital and Sposito summarises the situation in a heading, "Most of the water consumed globally by croplands is green water", where "green water" is that which arrives by rainfall and about one-fourth of all water from rainfall goes into agricultural ecosystems, about equally partitioned between croplands and pasturelands.

The rhizosphere within the soil surrounding plant roots is vital. Green water flow necessarily must go through the rhizosphere to be productive, according to Sposito. There is feedback from plant roots into the rhizosphere of mixtures of carbon compounds, collectively termed mucilage, and plant growth can increase the water-holding capacity of soil through the incorporation of the mucilage. Hence agriculture, done wisely, can actually improve soil. Indeed, from Sposito "any agricultural practice dedicated to increasing global food production by at least 65-70% during the next 40 years can be judged sustainable only if it does not undermine the natural capital of the soils and the integrity of the water resources used to grow crops".

Reference to the natural capital of soils brings us back to the ideal of soils as biological ecosystems as described by Monbiot, for example. As Dr Worm/Frank Ashwood told Michele Hewitson in *The Listener*, soil guards its secrets very closely. Sposito, in his 2014 chapter, points to the paucity of knowledge about the composition and workings of the soil biome, which says the same thing. He quotes a 2004 review paper in *Science*[11] in which the authors (J.R McNeill and V. Winiwater) describe complex soil ecosystems "which remain firmly, but uncharismatically, at the foundations of human life".

Soil, then, can generate wonder and mystery as well as helping to feed us. Expressions of wonder and mystery about them does not come naturally to soil scientists involved in the hard grind of analytical work and experiments to assess their usefulness and resilience. It may especially escape pragmatic New Zealanders. But there have been exceptions in the past. I recall former colleagues in the old Soil Bureau like Jan Heine, Ted Cox, Les Molloy, John Bruce, and Val Orchard who were capable of going beyond quantitative descriptions of soils into the more "poetic" realms (Fig.3) and some of you may have met Richard MacEwan of Victoria in Australia to whom an 'arty' view of soils comes naturally. You, and especially older readers from other Institutes, will be able to name some others like that (Fig. 4). Do today's soil scientists get the time or opportunity to widen their perspective on soils in this way? Can *Soil News* help?



Figure 3. Iain Campbell in the stance of a (weathered) rock star expounding on a soil profile seen in the field trip during the NZ Society of Soil Science Conference in Nelson in 1988. Often soil scientists were at their most "poetic" in the field.



Figure 4. Delegates at the combined Australia-New Zealand Societies of Soil Sciences at Massey University in 2008. There are a few wider thinkers about soils among those pictured.

I am by no means encouraging us all to leave the realm of evidence-based science to just inhabit the clouds of fancy and feelings. As an aside, it can be argued that much of current politics worldwide is infected by feelings at the expense of practical policies.

Nonetheless, the fact remains that the natural marvel of soils can be undone, releasing carbon, often through their common uses. For the sake of all our futures, we should certainly Never Treat Soils like Dirt.

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News from the Regions

Waikato/Bay of Plenty

University of Waikato

International Collaborations & ICOS Conference

Aaron Wall recently travelled to Ireland and to Lund, Sweden, for the Integrated Carbon Observation System (ICOS) meeting. He visited research collaborators from the joint MAPSERS project, which investigates carbon losses from drained peat soils in both countries, New Zealand and Ireland. At ICOS, Aaron presented a poster highlighting more than a decade of remarkable carbon uptake at Kopuatai Peat Bog (work led by **Dave Campbell**) and delivered a talk comparing eddy covariance carbon balance measurements in agricultural settings with changes in measured carbon stocks. While in Lund, he also caught up with former WaiBER group member and friend **Susanna Rutledge-Jonkers**, now based in the Netherlands.



Figure 1. Aaron Wall catching up with former WaiBER member Susanna Rutledge-Jonkers at the ICOS meeting in Lund, Sweden.

Postgraduate Milestones

Double congratulations to **Mohan KC**! Mohan recently submitted his PhD thesis, *"Carbon dynamics in intensively managed temperate pastures in response to grazing management and soil moisture stress,"* and had the second paper from his thesis accepted for publication. In accordance with group tradition, he baked and decorated a "research cake" illustrating his key findings.



Figure 2. Mohan KC celebrating his PhD thesis submission and newly accepted paper with a research cake.

Manawatū

Bioeconomy Science Institute

DHS Delivers Key Building Blocks for Orchard System Simulation

BSI researchers have completed the first 5-year phase of the SSIF-funded Digital Horticultural Systems (DHS) Growing Futures Direction. Through the Simulating Orchard Ecosystems programme in DHS, teams developed or upgraded thirteen digital biophysical models representing key components of apple orchard systems beyond the tree itself, including:

- An orchard ecosystem health index integrating soil, plant, pest, climate, management and socio-economic indicators into a single measure of system performance and resilience
- Models of soil water balance, temperature, carbon and nitrogen
- An understory plant-community model
- A universal disease model covering fire blight (*Erwinia amylovora*), black spot (*Venturia inaequalis*), canker (*Neonectria ditissima*) and bull's eye rot (*Phlyctema vagabunda*) across the apple-growing season
- Models of orchard pests, predators and pollinators

Together, the models provide a critical foundation for the BSI's horticultural digital twin. Stored in the DHS model library, these tools can be combined with tree models and with one another to test complex orchard-management questions. For the soil carbon and nitrogen model development in the Simulating Orchard Ecosystems programme in DHS, Roberta Gentile and Rogerio Cichota lead a team

that have recently completed a three-year study to measure nitrogen fluxes across two apple production systems (tall spindle and planar cordon) and growing regions (Tasman and Hawkes' Bay) to develop partial orchard nitrogen balances. Results showed that plant residues returned more nitrogen to the orchard than was applied as fertiliser, demonstrating the importance of soil nitrogen cycling to crop nutrition. The research has strengthened understanding of carbon and nitrogen returns from perennial crop residues and informed a decomposition model for simulating orchard nitrogen flows within BSI's digital twin. Roberta presented this research at 32nd International Horticultural Congress in Kyoto, Japan in August.



Figure 1. Netting a planar cordon apple tree after harvest to measure residue returns from leaf senescence, and using litter bags to measure residue decomposition in orchard.

Massey University

Piezometer installation for groundwater monitoring

Researchers from the Farmed Landscapes Research Centre (FLRC) at Massey University have recently been carrying out groundwater monitoring work in coastal South Taranaki. As part of this work, a series of shallow (≤6 m depth) piezometers have been installed to allow groundwater samples to be taken for chemical analysis.

Hand augered boreholes are used to determine the depth to groundwater and describe the local geology. Understanding the geology helps guide installation depth and location and also provides a useful pilot hole to begin driving the outer casing of the piezometer into the ground using a fence post rammer (Figure 1-3). Piezometer installation involves driving steel casing into the ground with an inner steel rod. Once the target depth is achieved, the inner rod is removed and replaced with a PVC pipe with holes drilled in one end. The holes are protected by mesh to prevent sediment from entering the pipe once installed. Finally, downward

pressure is applied to the PVC pipe to keep it in place while the outer steel casing is hydraulically jacked out of the ground. All outer casing and inner rods are threaded at approximately metre increments so that they can be driven into or extruded out of the ground in metre sections.
The piezometers provide valuable and cost-effective access to groundwater for sampling. They need to be fenced off from cattle to prevent them rubbing and damaging the PVC pipe.



Figure 1. Colin Schreder and Bob Toes driving the outer casing into the ground using a 200 kg fence post rammer.



Figure 2. Andrew Boot, Prof. Ranvir Singh, Callum Rees, and Colin Schreder finish installing a piezometer. In the foreground, you can see the petrol generator and hydraulic pump that powers a hydraulic jack to remove the steel outer casing from the ground.



Figure 3. Callum Rees and Andrew Boot compacting soil around the newly installed piezometer before placing a bentonite cap to prevent surface water ingress into the well. Note the peristaltic pump in the foreground, which is used to sample groundwater from the piezometer.

Massey University Soil Science Society Community Day

Members of the Massey University Soil Science Society joined Ngāti Hauiti on 10 October 2026 for a community working bee in a native bush remnant near Rātā. The day focused on clearing tracks through dense blackberry and gorse to improve access for future spraying and ongoing restoration efforts.

The bush block contains several mature native tree species, including kahikatea, tōtara, pukatea, tawa, and tītoki. However, much of the native understorey has been overwhelmed by blackberry. The working bee is part of a long term Ngāti Hauiti project to gradually control pest species and encourage the regeneration of native vegetation.

Students spent the day cutting tracks through the blackberry and clearing fence lines to allow access for spraying (Figures 1-3). The event provided an opportunity for students to support local environmental restoration while learning more about the region and its landscapes.

The Massey University Soil Science Society would like to thank Te Tira Ahu Pae for providing transport and ongoing support for student activities. The group also enjoyed views of the Rangitīkei River terraces, a striking staircase like landscape that records the influence of repeated glacial-interglacial cycles over the past 350,000 years (Figure 4).



Figure 1. From left to right, Nicola Creedy, Kevin Perera, Callum Rees (Massey University Soil Science Society) and Utiku Potaka (Ngāti Hauiti) enjoying lunch after a morning spent clearing blackberry and gorse.



Figure 2. Callum Rees clearing a fence line to provide access for blackberry spraying. Note the kahikatea tree in the background.



Figure 3. Massey University Soil Science Society students Shiromi Samiraja and Nicola Creedy on a track cut through blackberry to provide access for spraying.



Figure 4. View of the native bush remnant (lower right hand side) on the Holocene floodplain of the Rangitīkei River Valley. Photo taken by Callum Rees from the Last Glacial Maximum terrace looking north.

Special Issue on Southern Hemisphere Dust Production, Transport and Loess Deposition Published in the New Zealand Journal of Geology and Geophysics

Our special issue on dust and loess for the New Zealand Journal of Geology and Geophysics is finally out!

This is the first dedicated collection of papers on dust and loess from Aotearoa New Zealand and southern South America published in more than 30 years. The issue brings together research on dust production, transport and deposition, spanning topics from paleoclimate and landscape evolution to ocean biogeochemistry and human impacts.

One highlight for me is seeing Alan Palmer's contribution published. He completed his PhD in 1982, meaning parts of this work have been more than four decades in the making.

A huge thanks to all the authors, reviewers, editors and journal staff who helped make this issue happen.

If you're into loess, go check it out: https://lnkd.in/eSv6ywPW

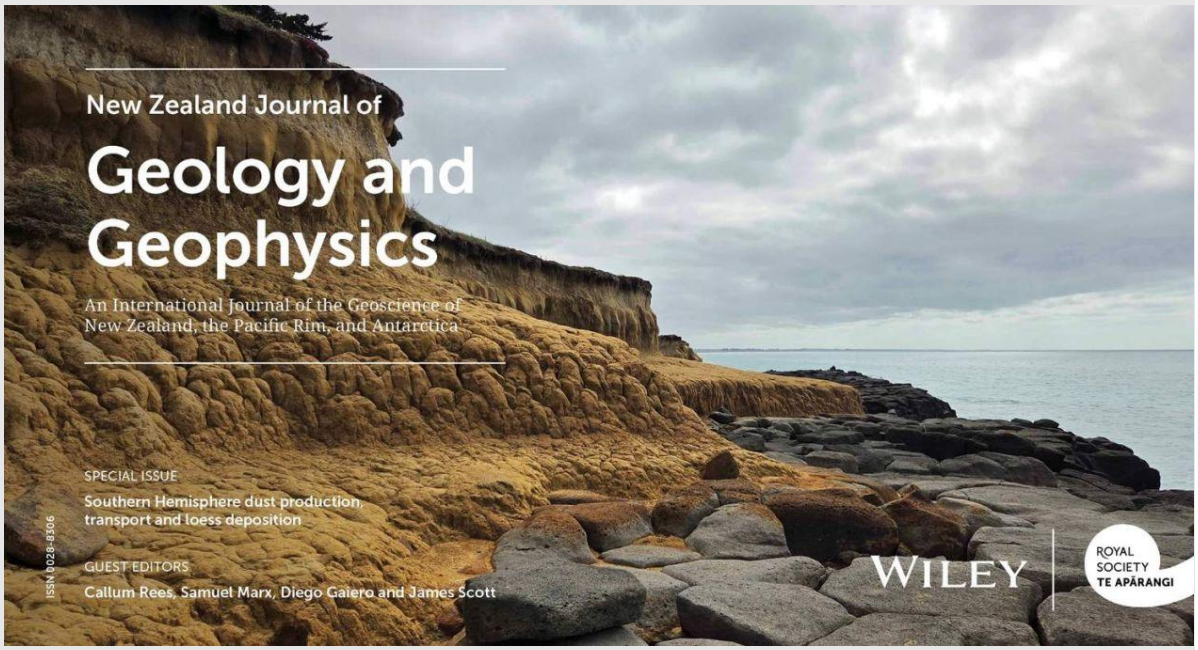


Figure 1. Cover of the special Issue on Southern Hemisphere dust production transport and loess deposition in the New Zealand Journal of Geology and Geophysics.

Canterbury and Otago

Lincoln University

Lincoln University Hosts International Soil Experts for GLOSOLAN Workshop 23 - 24 October

Professor Tim Clough had the pleasure of helping get the GLOSOLAN workshop (Global Soil Laboratory Network) underway with colleagues from the FAO. GLOSOLAN is supported by FAO's GSP Secretariat, and brings together around 800 soil laboratories from over 140 countries and advances technical cooperation, knowledge exchange and capacity development in response to local needs. The event aims to share experiences and challenges related to soil testing and interpretation within the Pacific network while strengthening regional collaboration and future engagement within GLOSOLAN. Building on the workshop, international experts are continuing their collaboration throughout this week to develop a finalised draft of "Soil Test Results: Practical Guidelines for Farmers – Volume 1: Soil Physical Properties", in preparation for submission to the editorial review process.

With many of the world's leading experts in soil physics attending, the event provides an excellent opportunity to showcase the outstanding research, expertise and facilities at Lincoln University's Science Hub, while fostering valuable international partnerships and advancing soil science knowledge and practice.



In the field with our advanced soil science and soil resources students

During the mid semester break, the combined SOSC301 and SOSC627 class embarked on their 4 day field trip to Marlborough. Based in the Awatere valley, Mt Adde station is a 237 Ha property, with 57 Ha of vines and 180 Ha in hill country. We worked with Lincoln Alumni, Matt Oliver from Marlborough District Council, who used his digger to open up soil pits across the station.
The objective of the trip was to understand the relationship between the soils and the landscape, on terraces of different ages and parent material; and how to use this knowledge to inform questions that the landowner was interested in. Are there areas suitable for sustainable forestry, high-quality terroirs for grapes or alternate crops? Could grazing and vineyard productivity be lifted? Could some areas be retired due to erosion risk?
Every day, the students worked in the field to describe soils across different parts of the landscape. The spell of NW weather (i.e. it only drizzled on the last day) contributed to all our pits being described. Hurrah!
The benefit of having both 300 level and a range of PG students (MEAgr, MINC, MPrAg) was peer to peer learning in an immersive environment and also modelling graduate level working in multidisciplinary groups to create reports.
The students are now using their field collected soil data in combination with digital resources, to create a professional standard report. This constitutes a major component of their assessment on their course. It also demonstrates the importance and value of practical classes in the field; where hands on learning and deep engagement with the topic occurs.















Bioeconomy Science Institute

International Symposium on Earthworm Ecology

In August, **Nicole Schon** attended the International Symposium on Earthworm Ecology held at Wageningen University, in the Netherlands. The theme was from the lab to the field, from the field to the lab. During the five day conference she presented in the Soil functioning and biogeography session on ‘Changes in earthworm populations in grazed hill country pastures with contrasting phosphorus fertiliser histories since 1975’. Alongside this, she presented two posters on ‘Using qPCR to assess earthworm species and abundance: a New Zealand example’ and ‘Impact of regenerative management practices on earthworm populations in pasture soils’. A highlight of the conference was the field trip to the characteristic Dutch peat meadows, with a stop at the PolderLab. Challenges faced by the peat meadows were discussed, with solutions being trialled including growing rice and cranberries. Of course, a trip to Wageningen would not be complete without a Worm Charming contest.

New Zealand Grasslands Association conference: Optimising dryland farming

Recently **Ross Mongahan, Anna Taylor** and **Nicole Schon** travelled to the New Zealand Grasslands Association conference in Blenheim, with the theme of Optimising dryland farming. Anna presented on ‘Evaluating pasture-based dairy cow wintering systems across soil and climatic conditions in southern NZ’, which extended some of the themes discussed in the recent wintering review by Monaghan et al. (2026). Nicole presented two papers at the conference: ‘Impact of diverse pastures and reduced nitrogen inputs on dairy pasture yields, botanical composition and soil health’ and the ‘Application of spent mushroom compost to a riverine silt loam at pasture renewal’. Fieldtrips included a visit to Pyramid and Bonavaree Farms which showcased diversification and innovation across the farm system.

Southland

Environment Southland

Field days: El Nino and Soil management

Soil moisture levels for September and October have been averaging over 85% across 19 sites, while soil temperatures have been steadily climbing to be averaging about 14 degrees currently (Early November). We had the wettest winter on record since 1984 and so the soils are still very saturated in places which has hampered post winter resowing of pasture and crops due to lack of accessibility for cultivation. The region is in a medium adverse event (for wetness) as agreed by the Minister of CDEM. While the ground has dried on the surface during October with some late month sunshine and windy conditions which has been beneficial to getting some cultivation done anything not cultivated will have sealed at the surface from compaction and pugging from intensive grazing which has caused a watch for overland flow issues.

Abstracts

Soils and Ecosystems Across the Junction Hill Moraine Sequence (South Westland) With Variable Ultramafic Characteristics, New Zealand Journal of Geology and Geophysics

Geochemical constraints imposed by ultramafic lithologies strongly affect soil and ecosystem development, typically signified by elevated trace element concentrations, nutrient imbalances and reduced biological productivity. In a reconnaissance study, we assessed the variability of soil and ecosystem conditions across a moraine complex with mixed felsic and ultramafic lithologies and variable site conditions (vegetation cover, surface ages and topographic position). Soils under a continuous vegetation/litter cover located on flatter topography were more acidic, had lower trace element concentrations, a more balanced nutrient supply and more soil organic carbon compared to soils on ridges or sloping ground associated with patches of bare ground and reduced plant productivity. Most parsimoniously, these contrasts are likely a consequence of the variable contribution of ultramafic parent material, but it is also possible that a combination of other site factors (e.g., erosion, soil hydrology and distance from seed sources) are at least contributing factors for the spatial variability of above- and below-ground ecosystem conditions. More work is required to better understand the drivers behind the observed variability.

Andre Eger, Peter Almond, Jo Cavanagh, Isaac Larsen, *Soils and Ecosystems Across the Junction Hill Moraine Sequence (South Westland) With Variable Ultramafic Characteristics*, *New Zealand Journal of Geology and Geophysics* 2026, 69, e70075. https://doi.org/10.1002/jgo2.70075

Solid- and water-induced impedance to soil-gas diffusivity and tortuosity in partially saturated porous media: a complex-plane representation

Knowledge of soil-gas diffusivity (Dp/Do, where Dp and Do are gas diffusion coefficients in soil and in free air, respectively) and its relationship to soil moisture is critical for understanding soil functions in natural, agri cultural and engineered soils. It also serves as a useful diagnostic tool to fingerprint functional soil structure. The traditional power-law expressions that predict Dp/Do treat impedance to diffusive gas flow as fitted empirical parameters which lack independent physical identity. They further provide no mechanistic distinction between porosity limitation and directional shift as two separate constraints. This study introduces a complex-plane representation which decouples the two distinct impedances: air phase availability (primary impedance), rep resented as a multiplicative magnitude, and directional changes of diffusivity (secondary impedance) represented as an additive phase angle (γ) within a polar Argand framework. Using Dp/Do data for two idealized media with spherical particles, 13 texturally diverse repacked soils, and six undisturbed soils under variably saturated conditions, we demonstrate the shift of the effective impedance angle under changing soil moisture. The total impedance angle (γt) dropped from 90◦ at the very wet soil to 47 - 65◦ at completely dry soil with only 4-5% variation across soil texture and structure. However, the water-induced impedance angle (γw) changed consid erably with soil structural status, varying by ~19% around its mean in repacked soils and 29% in undisturbed soils, despite limited soil textural effects. We further show that traditional geometric tortuosity (τ^2) naturally emerges as a unit complex scalar ($e^{-i\gamma t}$) in the proposed complex plane, thus projecting a geometric shadow onto the vertical (real) axis of the Argand plane ($\tau^2 = 1/\cos \gamma t$). Results thus illustrate the potential of the new framework to separately represent the dual impedance which existing models lump into fitting coefficients, providing a mechanistically based tool to characterize soil functional structure in natural and engineered porous media.

Deepagoda C, Lakshani MMT, Picard M, Clough T, Carrick S, Hu W, Zhou B, Li M, Li J, Drewry J, Ekanayake J, Cameron K, Di H, Beare M, Clothier BE, Smits K. 2026. Solid- and water-induced impedance to soil-gas diffusivity and tortuosity in partially saturated porous media: a complex-plane representation. Advances in Water Resources 218: 105514. https://doi.org/10.1016/j.advwatres.2026.105514

Impact of topsoil compaction on crop and pasture yield under varying climates and soil textures: a data synthesis

Soil compaction caused by machinery traffic or livestock grazing typically reduces crop and pasture yields, lowering farmer incomes while increasing input costs for tillage, irrigation, and nutrients. However, few studies have quantified how yield responses to compaction vary across soil textures and climates. Here we synthesise published data to quantify the relationships between yield and soil physical indicators, and to evaluate the moderating roles of soil texture and climate. We extracted yield responses to bulk density (BD) and degree of compaction (DoC) from the literature and conducted a global synthesis using main-effect regression models. Across studies, yield responses followed two dominant patterns: a negative linear decline with increasing BD or DoC, or a quadratic

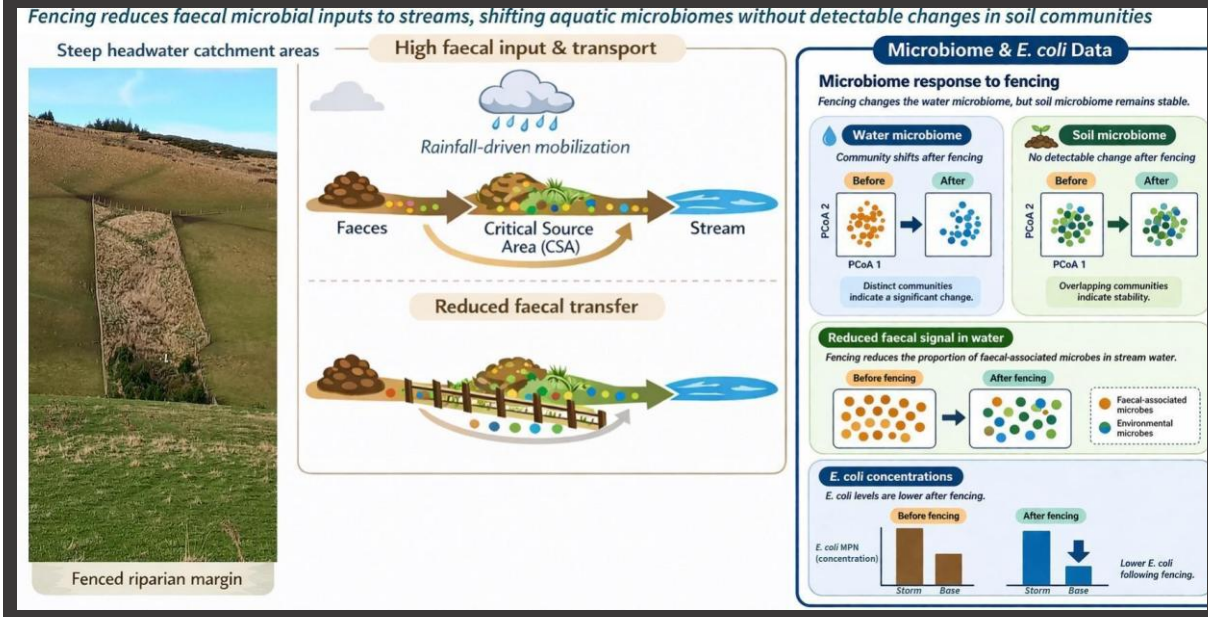
response with yields increasing to an optimum and then declining. For quadratic relationships, coarse-textured soils tended to show a higher optimum BD but a lower optimum DoC than fine-textured soils. Dry climates tended to show a higher optimum BD and a lower optimum DoC than wet climates. Beyond the optimum, whether inferred from linear or quadratic relationships, wet conditions had a less negative yield-DoC slope than in dry conditions, suggesting greater vulnerability to compaction in drier climates once critical thresholds are exceeded. Knowledge gaps include the lack of studies relating pastoral and many crop responses specifically to dynamic structural values (e.g., air capacity, available water capacity, penetration resistance, and aggregate stability) across textures and climates.

Drewry JJ, Yan G, Hu W, Zhao Y, Zhang W, Cichota R, Shang Z, Li J, Yang J, Clothier BE, Beare MH, Deepagoda C, Clough TJ, Peth S. 2027. Impact of topsoil compaction on crop and pasture yield under varying climates and soil textures: a data synthesis. Soil & Tillage Research 265: 107401. Special issue: Functional Assessment and Productivity Improvement of Soil-Plant Systems. https://doi.org/10.1016/j.still.2026.107401

Fencing off critical source areas reduces faecal contamination and reshapes microbial communities in agricultural headwater catchments

Agricultural headwater catchments are critical sources of microbial contamination to surface waters, yet the effectiveness of mitigation practices in these small, dynamic systems is not well defined. A paired-catchment experimental design was used to assess the effects of permanent fencing of critical source areas (CSAs) in ephemeral streams within deer-grazed pastures. Faecal, soil, and freshwater samples were collected over four years, comprising two years of baseline monitoring and two years following mitigation. Viable *Escherichia coli* concentrations were measured in faeces, soil and water alongside high-resolution microbiome profiling and microbial source tracking.
Microbiomes of freshly voided faeces were dominated by anaerobic taxa (Bacteroidia, Clostridia and Spirochaetia) which were significantly reduced ($p < 0.001$) in aged faeces and replaced by aerotolerant Actinobacteria, Alphaproteobacteria and Gammaproteobacteria ($p < 0.001$). Fencing reduced *E. coli* concentrations in CSA soils by 87.4% ($p < 0.0001$) and by 47.0% ($p = 0.041$) in storm event flows, with the strongest effects in water during baseflow conditions with a 60.6% ($p < 0.0004$) reduction in *E. coli*. Freshwater microbial alpha diversity increased in the treated catchment, while soil microbiomes remained stable. Beta diversity analyses indicated distinct shifts in freshwater communities after the permanent fenced treatment, but shifts in the CSA soil microbiomes after fencing were not observed. Source tracking indicated reduced CSA soil contributions ($p < 0.001$), with a greater relative influence of aged faeces during storm events ($p < 0.0001$).
These results demonstrate that fencing off CSAs can lower faecal inputs and alter aquatic microbial communities. Culture-based and sequencing approaches provided complementary insights into contamination patterns, linking observed reductions in *E. coli* concentrations to changes in microbial diversity and community structure. This work highlights how mitigation targeting CSAs can influence both water quality and freshwater microbiomes, and underscores the

value of integrating traditional monitoring with molecular methods in evaluating agricultural management practices.



Cookson, A. L., et al. (2026). "Fencing off critical source areas reduces faecal contamination and reshapes microbial communities in agricultural headwater catchments." Science of the Total Environment **1041**: 181867. https://doi.org/10.1016/j.scitotenv.2026.181867

Managing the environmental impacts of outdoor winter grazing by livestock

This review presents a synthesis of current knowledge about managing the potential impacts of outdoor animal wintering activities and their consequences for a range of environmental outcomes. The scope is confined to field-based wintering approaches and thus, does not consider issues associated with the winter use of animal shelters or standoff systems. Studies that have documented some effects of winter grazing activity are summarised focussing on outcomes for soil condition, nitrogen (N) leaching and contaminant transport via surface runoff. Four key themes are shown to influence environmental outcomes: (i) grazing pressure, (ii) dietary N intake, (iii) landscape vulnerability attributes and (iv) the use of subsequent catch crops. A suite of relevant planning and management considerations are listed that align with pre-, during- and post-grazing phases of wintering systems. Some initiatives to address remaining knowledge gaps and assess effects that future changes to animal wintering practices may have on environmental outcomes and consequences for the farm system are also provided.

Monaghan, R. M., Malcolm, B., Ghimire, C. P., Smith, L.C., Longhurst, B. 2026. Managing the environmental impacts of outdoor winter grazing by livestock. New Zealand Journal of Agricultural Research. 69, e70089 https://doi.org/10.1002/jag2.70089

Evaluating pasture-based dairy cow wintering systems across soil and climatic conditions in southern New Zealand: implications for nutrition, welfare and environmental risk

Autumn-saved pasture offers a potentially attractive alternative for wintering livestock in the South Island, although variability in feed accumulation and uncertainty over suitability on poorly drained or structurally vulnerable soils constrain adoption. We evaluated pasture-based wintering using six case-study farms across Canterbury, Otago and Southland selected to represent a range of soil, landscape and rainfall conditions. Kale and fodder beet paddocks within a wintering system were also assessed on two farms. System performance was evaluated using proxy indicators including assessments of ground cover (drone-derived), soil condition, cow cleanliness, body condition score and diet adequacy. Overall, body condition score (BCS) outcomes from the pasture wintering case studies indicated adequate nutrition
despite variation in estimated ME supply. Where soils were suitable, pasture systems delivered improved cow cleanliness and reduced environmental risk compared with forage crops that were monitored on two of the farms. Successful outcomes were associated with permeable, structurally resilient soils and lower grazing pressures (≥15 m^2 cow^{-1} day^{-1}) than typically applied to winter forage cropping systems.

Taylor, A., Monaghan, R., White, A., Smith, C., Cumming, R., Crawford, M., Tomasetto, F., & Dynes, R. (2026). Evaluating pasture-based dairy cow wintering systems across soil and climatic conditions in southern New Zealand: implications for nutrition, welfare and environmental risk. *Journal of New Zealand Grasslands*, *88*, 167-176. https://doi.org/10.33584/jnzg.2026.88.3910

Impact of diverse pastures and reduced nitrogen inputs on dairy pasture yields, botanical composition and soil health across three regions

Pastoral farmers can enhance productivity and minimise environmental impacts by utilising a range of management practices on farm. Different pasture management options being explored for their potential benefit to the farm and wider ecosystem include the use of diverse pasture species and targeted fertiliser nitrogen (N) inputs. On each of nine dairy farms across Waikato, Canterbury and Otago, one paddock was sown with a pasture mix containing perennial ryegrass/white clover/plantain (simple) and an adjacent paddock sown with an additional 12 species (diverse). Half of each paddock received either standard or low N fertiliser inputs. Herbage yields were determined for three years, with pasture species composition assessed seasonally. Soil health was assessed annually using measures of soil fertility, organic matter, physical condition and biological abundance. Total annual pasture yields were no different between the simple and diverse pastures. Pasture growth tended to be reduced in response to lower N fertiliser inputs, although results were not significant. The most consistent pasture responses to N were seen in Canterbury under irrigation. Under low N inputs there was a small increase in white clover (>1%), and although non-significant still created the potential for
increased biological N2 fixation. Plantain declined during the study from 20±2.7% to 2±0.8% in both pasture types. Grass contributed over half of the pasture sward.

Although ryegrass was the dominant species in both pasture types, diversity remained higher within the diverse sward in the final year of study, with other grass species contributing up to 20±1.8% of the pasture sward. There was no effect of pasture type, N rate, or their interaction on any measured soil health property.

Schon, N. L., Laurenson, G., Moss, R., Barlow, R., Sprosen, M., Cumming, R., Taylor, A., Catherwood, D., Mackay, A., Dodd, M., & Moorhead, A. (2026). Impact of diverse pastures and reduced nitrogen inputs on dairy pasture yields, botanical composition and soil health across three regions. *Journal of New Zealand Grasslands*, *88*, 143-156. https://doi.org/10.33584/jnzg.2026.88.3899

Application of spent mushroom compost to a riverine silt loam at the time of pasture renewal and its effect on soil infiltration rate

Pasture renewal is an important strategy for maintaining pasture production. While cultivation during pasture renewal can improve soil macropores in the short term, these benefits do not necessarily persist. Evidence from previous studies indicates that compost applied to agricultural soils can improve soil physical properties and increase earthworm numbers. We assessed whether adding mushroom compost at the time of pasture renewal would have further benefits on soil infiltration. We applied commercial mushroom compost to a riverine silt soil that had low soil infiltration and regularly ponded temporarily during irrigation events. The experimental treatments were assigned to replicated field plots (5m x 6m) and included: A) no pasture renewal, no cultivation, B) pasture renewal, no cultivation, C) pasture renewal, cultivated, D) pasture renewal, cultivated, 50t/ha compost applied, E) pasture renewal, cultivated, 100t/ha compost applied, and F) pasture renewal, cultivated, 150t/ha compost applied. Soil infiltration rates measured 2 months after initiating
treatments indicated no difference between plots that were cultivated and amended with compost compared with those plots left under the original pasture (and without cultivation). However, for pastures that were renewed via direct drill (i.e., without cultivation), soil infiltration rates were significantly ($P<0.05$) lower than all other treatments and likely reflected surface soil damage that was caused by heavy rainfall soon after drilling new seed rather than the absence of compost. After 14 months none of the management approaches for renewing pastures that we assessed were found to have a lasting effect on soil infiltration rate. Earthworm numbers and total earthworm biomass measured after 7 months were not significantly different across treatments across all compost rates evaluated. However, earthworm biomass tended to be lower in the cultivated soils compared with the non-cultivated treatments ($P<0.10$). This experiment indicates that a single application of mushroom compost during the renewal of pasture had limited benefit in improving soil infiltration rates or increasing earthworm numbers within 14 months after pasture renewal.

Schon, N. L., Laurenson, S., & Moss, R. (2026). Application of spent mushroom compost to a riverine silt loam at the time of pasture renewal and its effect on soil infiltration rate. *Journal of New Zealand Grasslands*, *88*, 193-200. https://doi.org/10.33584/jnzg.2026.88.3885

Book chapter:

Macrofauna as indicators of soil health: earthworms and enchytraeids

Reports highlighting the degradation of soils in Europe and worldwide are flourishing (Akça et al., 2024; Pennock et al., 2015; Smith et al., 2024). These reports emphasize that 33% of soils are moderately to highly degraded and face significant threats, including biodiversity loss (Pennock et al., 2015). This is particularly concerning as soils support 59% of all life on Earth (Anthony et al., 2023). In this context, developing biological indicators for soil health is essential for identifying strategies for soil monitoring and improvement. Soil fauna, almost exclusively consisting of invertebrates, represent a substantial portion of life in soils, i.e. around 23% of total species number (Decaëns et al., 2006), and play a critical role in maintaining and enhancing soil quality and providing ecosystem services (Lavelle et al., 2006). This chapter focuses on two key soil faunal groups, earthworms and enchytraeids, as potential soil health indicators.

Vidal, A., Pelosi, C., Brown, G., Schon, N., Calogiuri, T., Van Groenigen, J. (2025). Macrofauna as indicators of soil health: earthworms and enchytraeids. In: Norton, J., Schimel, J., Lindo, Z. (eds) Measuring and assessing the biological health of soils. Burleigh Dodds Series in Agricultural Science, vol 173. Burleigh Dodds Science Publishing, Cambridge, UK. https://doi.org/10.19103/AS.2025.0159.09

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We are the New Zealand Soil News:
Editor: **Balin Robertson** – robertsonb@landcareresearch.co.nz
Correspondents: **Thomas Caspari,** Bioeconomy Science Institute - Manaaki Whenua-Landcare Research (Lincoln); **Josie Mazzetto,** Lincoln University; **Callum Rees**, Massey University; **John Drewry**, Environment Southland; **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); *Vacant*, Bioeconomy Science Institute - Scion