



Welcome to the Soil News

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

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From the Editor

Welcome to this issue of Soil News.

In the August 2022 issue of Soil News, Phil Tonkin wrote an article on the history of soil classification in New Zealand and Allan Hewitt's considerable contribution. Some members with an interest in pedology, soil classification or soil conservation, may wish to seek further information - Phil wrote several articles published in Soil News in 2007.

Phil wrote at the end of his 'part two' article, "There have been many significant developments over the past two decades that are now being used in soil and land resource mapping and data management. The S-map initiative and programmes such as SLURI and landowner education packages such as SUBS are showing there is renewed activity. Such activity will need the training of a new generation of soil and land resource scientists, technologists and advisors. The tertiary institutions with the capability to provide this training will need society's support".

Phil's statement also holds true in 2022, with recent and current renewed activity, interest and resourcing into many aspects of soil research and digital soil mapping, including the need for developing capability and training in soils and soil research. Phil Tonkin's articles are available in Soil News:

"A history of soil survey and selected aspects of soil conservation in New Zealand, Part One" Soil News volume 55 (2) pages 59-71 (2007); and

"A history of soil survey and selected aspects of soil conservation in New Zealand, Part Two" Soil News volume 55 (3) pages 102-115 (2007).

After several years, the issues of Soil News are now loaded onto Manaaki Whenua's Digital Library, so will be available for many past volumes and a wider audience. All issues that are loaded have a Digital Object Identifier (DOI) created for them to provide a permanent URL and facilitate citation.

<http://digitallibrary.landcareresearch.co.nz/digital/collection/p20022coll30/search>

Soil News is your newsletter - if you would like the opportunity to publish an article, contact the editor.

Many thanks to Roberto Calvelo-Pereira, who has been a Soil News correspondent for Massey University for the past three years. We welcome Callum Rees as the new correspondent.

This issue of Soil News has an article on the National Policy Statement on Highly Productive Land. A recent TV1 'Sunday' programme (2 October 2022) had an article about 'solar farms' with many paddocks of solar panels, typically occurring on flat land and near substation or electricity grid infrastructure. Some cases are also likely to be on highly productive soils. An article is available from:

<https://www.rnz.co.nz/news/country/475251/future-of-some-farms-may-be-paddocks-with-grazing-cattle-and-solar-panels>

National Policy Statement on Highly Productive Land

The New Zealand Soil Science Society congratulates the New Zealand Government on releasing the National Policy Statement on Highly Productive Land. The Society, and a number of individual members, have long championed the need to protect against the significant ongoing loss of our best soils that are versatile for growing a wide range of crops. Such versatile soils are only a small percentage of New Zealand's land area, located as individual areas in all parts of New Zealand. They underpin both domestic food supply, as well as New Zealand's export economy. The diversity of crops they support also help shape our regional identity - think of kiwifruit from Bay of Plenty, early potatoes from Pukekohe, citrus from Gisborne, grains from Canterbury, or summer fruits from central Otago. This national policy statement recognises the strategic importance of these soils to the nation, not just for today, but the generations to come.

Further information on NPS Highly Productive Land

Details on the NPS Highly Productive Land are available here

<https://www.beehive.govt.nz/release/government-enhances-protection-our-most-productive-land-%C2%A0>

<https://environment.govt.nz/acts-and-regulations/national-policy-statements/national-policy-statement-highly-productive-land/>

Protecting elite soils - Expert Reaction including statement from the New Zealand Soil Science Society:

<https://www.sciencemediacentre.co.nz/2019/08/16/protecting-elite-soils-expert-reaction/>

<https://www.stuff.co.nz/environment/129918806/long-overdue-new-rules-to-protect-nzs-mostproductive-farmland-welcomed>

Podcast - Sam Carrick on Radio New Zealand 'The fragile magic of highly productive land'

<https://www.rnz.co.nz/programmes/the-detail/story/2018859977/the-fragile-magic-of-highly-productive-land>



Photo: The Waiareka soil, classified as a Typic Vertic Melanic, developed in the basaltic tuffs and lavas in the downlands near Oamaru (Photo credit: Quentin Christie)

Further information on the productive capacity of our land and land fragmentation

‘Lincoln subdivision on high-class soils’ (Soil News in August 2022)

‘Sunday’ programme August 2022 “The price of progress”

<https://www.youtube.com/watch?v=LmcFI69j02I>

Pukekohe highly productive land issue. ‘Sunday’ programme May 2021

<https://www.1news.co.nz/2021/05/16/taking-stock-of-our-soil-how-housing-developments-are-threatening-nzs-fertile-land/>

‘Testing the boundaries to circumvent policy that aims to protect our best land and soils’, by Fiona Curran-Cournane (Soil News in May 2021)

Curran-Cournane F, Carrick S, Barnes MG, Ausseil A-G, Drewry JJ, Bain IA, Golubiewski N, Jones H, Barringer J, Morell L 2021. Cumulative effects of fragmentation and development on highly productive land in New Zealand. New Zealand Journal of Agricultural Research. (Open access).

<https://doi.org/10.1080/00288233.2021.1918185>

Curran-Cournane F, Golubiewski N, Buckthought L 2018. The odds appear stacked against versatile land: can we change them? New Zealand Journal of Agricultural Research 61(3): 315-326. (Open access).

<https://doi.org/10.1080/00288233.2018.1430590>



New Zealand Journal of Agricultural Research

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Prof. Tim Clough,
Lincoln University

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New Zealand is well respected for its agricultural research and development. The ***New Zealand Journal of Agricultural Research*** plays an important role in disseminating topical information to researchers in universities, research institutes, and other centres concerned with animal or pastoral science.

The *New Zealand Journal of Agricultural Research* publishes original research papers, review papers, short communications, book reviews, letters, and forum articles on:

- Production (soil science, fertilisers, forage crops, agricultural economics, agronomy, animal science and plant breeding)
- Protection (insect pests, plant pathology, weeds)
- Environmental quality (water quality, climate change, land degradation)

Visit the journal homepage today to read the most recent Special Issues:

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Guest Editor: Jim Moir

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Guest Editor: Nicola Schreurs

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Pedometrician awarded the IUSS Dan H. Yaalon Young Scientist medal

Congratulations to Manaaki Whenua pedometrician Yuxin Ma who was recently awarded the International Union of Soil Sciences Dan Yaalon Young Scientist medal.

Yuxin was awarded her medal at the 22nd World Soil Congress being held in Glasgow. The award honours Dan Hardy Yaalon (1924-2014), a professor of soil science at the Hebrew University of Jerusalem. Dan H. Yaalon had 57 years of an exceptional research career. He contributed to some of the most fundamental issues of soils in space and time as well as theory and history of soil science.

The Dan H. Yaalon Young Scientist Medal is awarded once every four years, to a researcher in his/her early scientific career (PhD student or postdoc researcher within the first 5 years after graduation). It is an award for a significant contribution that has advanced the science, success, methodology, or use of soil science. Yuxin contributed significantly to the pedometrics and pedology community by bridging pedology and digital soil mapping.



Research scientist Yuxin Ma with Professor Alex McBratney of Sydney University at the World Soils 2022 conference in Glasgow in August 2022.

22nd World Congress of Soil Science

Crossing Boundaries, Changing Society. 31 July - 5 August 2022, Glasgow

This was my 6th and probably last World Congress of Soil Science, and the third one that I have been involved in developing the programme in my capacity as Co-Vice Chair of IUSS Division 2 (Soil Properties and Processes). This involved participation in monthly meetings on over 30 occasions, and I was grateful that the committee agreed to hold these meetings at 9-10 am UK time to allow me to join!

Overall, I think that despite the many problems and challenges associated with organising and hosting the event both on-site and on-line, it was a successful meeting. Over 4,000 delegates were originally expected to attend the Congress, but this was reduced to around 2,000. Attendance was always going to be dominated by delegates from Europe, although I was pleasantly surprised by the numbers from North America. Notwithstanding issues with visas, the lack of numbers and diversity in terms of attendance was mainly due to a combination of problems associated with travel restrictions related directly and indirectly to the pandemic. This included the almost complete absence of participants from China and Japan, while national and institutional financial restrictions related to the pandemic probably prevented all but a few participants attending from many other countries. For example, only 4 or 5 delegates attended from New Zealand, and I encountered only 2 attendees from Australia, while in contrast to the situation in Rio de Janeiro in 2018, very few delegates attended from South America.

With regard to session chairs and oral presentations, the programme organisers made the decision that all oral presentations at the Congress had to be delivered in person which under the circumstances heavily favoured participants from Europe and North America. Likewise the session chairs were selected on the basis of the likelihood of being able to attend. Furthermore, the decision to assess abstracts and select oral presenters without access to author details ("blind") was a very wise decision in my opinion, and for the most part I think it was successful. While some of the selected oral presentations did not live up to expectations, I would rather have this than the "favoured selection" policy I have witnessed on far too many occasions at previous Congresses.

The location and venue were outstanding (I am slightly biased!), and while participation in large conferences such as this can be daunting and exhausting, I think they still play a valuable role in the continued development and advancement of soil science. The 2026 Congress will be held in Nanjing (China), while the 2030 Congress will be hosted by Canada in Toronto.

Leo Condron
Lincoln University



Photo: 22nd World Congress of Soil Science at the Scottish Event Campus, Glasgow

Congress report from Hadee Thompson

This was the first World Congress I'd attended and it was great. The conference location was stunning and the programme was diverse. I particularly enjoyed some of the fringe events that ran parallel to the conference programme. There was a session on the environment footprint (greenhouse gas and water use) of the conference, which was quite interesting. The conference organisers put a lot of effort into making choices to minimise waste which was great to see.

I enjoyed meeting so many enthusiastic soil scientists (though not many kiwis were there) and for the first time since starting my PhD project, managed to talk face-to-face with people working on the same topic as me. That was a bit of a highlight.

After the conference, I was lucky enough to visit Rothamsted Research and the long-term field trials they run there. Their soil archive was incredible (see photo), holding soil samples collected from the same plots since about the 1850s. Following this I spent a bit of time getting fully acquainted with the peat soils of the Outer Hebrides (see photo). I don't think I've ever seen such expansive deep moorland.

I have to say a big thank you for all of the support I had getting there, it was a long way to go and I couldn't have done it without help, so thank you to the IUSS, the Macauley Development Trust and SPCS at the University of Canterbury.



Photo: Peat soils of the Outer Hebrides

News from the Regions

University of Waikato

Congratulations to **Terry Isson** (senior lecturer) who has had a double success in research funding. Terry received a Smart Idea on enhanced rock weathering to determine practicality of the approach in New Zealand. He also received a Rutherford Fellowship to investigate how the earth's coupled carbon-silicon cycle works - how effective it is, how it responds to climate change, and the role biology plays in returning carbon back to the atmosphere.

A number of graduate students have submitted or completed their masters in the last couple of months. Congratulations to **Seager Ray** who submitted his MSc thesis, *differentiating the temperature response of soil fungi and bacteria*. Seager was supervised by Louis Schipper and Charlotte Alster and will be joining the WaiBER team as a research technician. Congratulations to **Caitlin Holm** and **Zetang Hawng Dau** for completing their MSc dissertations. Caitlin (studying part-time while working in the Geothermal, Air, Land, Ecology, Contamination team at the Waikato Regional Council) was supervised by Tanya O'Neill and Michelle Begbie (Waikato Regional Council) and investigated the *limitations of guidance and disclosure deterrents for historic sheep dip sites*. Dau's dissertation investigated the *distribution of trace elements [and urban soil quality], Kukutaaruhe Gully, Hamilton* (Figure 1) and was supervised by Tanya O'Neill and Reece Hill (Landsystems). Caitlin continues her work at Waikato Regional Council and Dau joins their team as an intern over the summer months.



Figure 1: Dau undertaking soil quality sampling (left) at the Fairfield Project site (right, showing the community garden with cropped area behind), Kukutaaruhe Gully, Hamilton.

Tanya O'Neill and **Dorisel Torres-Rojas** are thrilled their long-awaited PhD students have arrived in the country to help with their respective Marsden Fast Start research projects. **Megan Reaves** will join Tanya on her project which investigates pollutants in penguin colonies and whether nesting mounds can preserve geochemical signatures of specific anthropogenic events. Their first field season takes place this summer at Cape Bird, followed by a second campaign to Cape Hallett in December 2023. Megan comes from Wilmington, North Carolina, and completed an MSc degree investigating stable isotopes in penguin bone collagen, and whether isotopic changes reflect dietary changes over time (Figure 2, left).

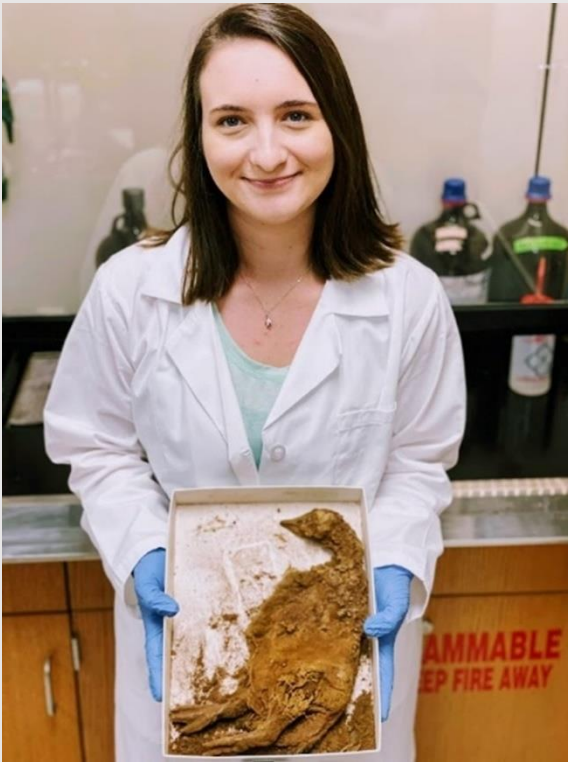


Figure 2: Megan with a long-dead Adélie penguin chick carcass used in her MSc research (left). Franco with a stunning Podzol! (right).

We welcome **Franco Alexis González** to Waikato University for his PhD research (Figure 2, right). Franco is from the city of Buenos Aires in Argentina, and will be working with **Dorisel Torre-Rojas** on her Marsden Fast Start on the interaction of ammonia with soil organic matter and how understanding these interactions can help us design practical solutions to mitigate ammonia and nitrous oxide.

Manawatu Plant & Food

Steve Green - Recipient of the Zespri NZ Kiwifruit Innovation Award 2022

Congratulations to Steve Green, Scientist Cropping Systems & Environment based at Palmerston North. Steve edged out other nominees to take out the prestigious Zespri Kiwifruit Innovation Award 2022 for his work in the sustainability and orchard input efficiency space.

He has designed and developed bespoke scientific apparatus for measuring the flow of nutrients and water in orchards, and in conjunction with his extensive modelling expertise he has provided the research tools to measure, predict and optimise water use and nutrient management in the whole suite of growing locations in NZ and Italy.

Steve's work has been used by growers, community groups, councils, government agencies, research collaborators and Zespri to understand the environmental footprint of kiwifruit, such is the application of his expertise. He remains a key provider for Zespri towards achieving their ambitious sustainability goals in the water and nutrient space.

An acknowledgement to the Zespri Innovation team for putting forward the nomination and who have supported these workstreams, in particular Juliet Ansell and Octavio Perez Garcia.



Bruce Cameron (Chair Zespri board) Steve Green, Kristy McDonald (Chair KNZ), Mark Mayston (Chair, NZKGI)

Manaaki Whenua - Landcare Research

A number of Manaaki Whenua soil scientists attended the 2022 Australia-New Zealand digital soil mapping community of practice workshop at the University of Sydney recently. The workshop was organised by members of the Australian Collaborative Land Evaluation Project working group on digital soil mapping and was sponsored by Australia's Terrestrial Ecosystem Research Network (TERN).

Lauren O'Brien, Nathan Odgers and Pierre Roudier attended in person. The workshop provided an opportunity for participants to share their progress with digital soil mapping in their regions over the last couple of years. The kiwis were able to share some of their latest work on S-map projects, national soil property mapping and infrared spectroscopy of soils.

Congratulations to Raphael Spiekermann who has also successfully defended his PhD. Raphael's PhD was on 'Quantifying the performance of silvopastoralism for erosion and sediment control in New Zealand's hill country'. Raphael has published several papers from his PhD:

- Quantifying the influence of individual trees on slope stability at landscape scale. J. Environ. Manage. 286, 1-18. <https://doi.org/10.1016/j.jenvman.2021.112194>
- Quantifying effectiveness of trees for landslide erosion control. Geomorphology 396, 1-16. <https://doi.org/10.1016/j.geomorph.2021.107993>
- Development of a morphometric connectivity model to mitigate sediment derived from storm-driven shallow landslides. Ecol. Eng. 180, 106676. <https://doi.org/10.1016/j.ecoleng.2022.106676>

Raphael decided to head back to Austria for work and family, and left Manaaki Whenua in November after seven years. Raphael contributed greatly to our soil erosion and mitigation research during his time here.

Soil Horizons is our annual web-based newsletter updating stakeholders on recent soil and environmental research. This issue of Soil Horizons presents recent research on soil carbon, impacts of climate change on erosion, irrigation, measuring drainage losses, farm-scale mapping, predicting soil mapping using tephra, soil health, and nitrous oxide emissions. It's available here: <https://www.landcareresearch.co.nz/publications/soil-horizons/>

Massey University

FLRC 35th Annual Workshop 2023



The FLRC workshop is to be held at Massey University, Wednesday 8th to Friday 10th February, 2023.

The title of this year's workshop is:

DIVERSE SOLUTIONS FOR EFFICIENT LAND, WATER AND NUTRIENT USE

The workshop will involve oral and poster presentations under the following general themes:

- Agricultural GHG Accounting and Mitigation
- Catchment Perspectives
- Farm Environment Planning
- Nutrient Attenuation; In field and Edge of field practices
- Policy Development and Implementation
- Smart Tools and Technologies
- Soil Conservation and Management
- Synergies in Solutions for Climate Change and Water Quality
- The Role of Nutrient Budgeting in Farm and Environmental Management
- Transformative Landuse for Future Farming
- The themes are a general guide as to session titles over the course of the workshop, and are subject to change.

Registration to attend the workshop will be available soon. If you wish to submit an abstract, visit the [Presentation Portal](#) - these must be submitted by the 15th of November.

If you have any queries about the abstract submission or registration process, please do not hesitate to contact Britta van Uden on britta@eventdynamics.co.nz, 021 122 6870.

For further information, visit the website <https://www.massey.ac.nz/~flrc/> Ensure you encourage any colleagues who haven't already signed up to our address database to contact Britta van Uden so they are able to receive regular Workshop updates.

We look forward to seeing you in February!

Importance of geology, soil and landscape information for Freshwater Farm Plans

Associate Professor Lucy Burkitt and Lecturer Mike Bretherton from the Environmental Sciences Group at Massey University have recently published a paper highlighting the importance of considering geological, soil and landscape factors to ensure Freshwater Farm Plans are successful in meeting the 2020 Essential Freshwater package objectives. They argue greater emphasis should be placed on understanding a farm's natural resources, as they provide the physical interface between the farming system and both the freshwater and atmospheric ecosystems.

Both Lucy and Mike have been running Farm Environment Planning professional development courses through the Farmed Landscapes Research Centre (FLRC) at Massey University. These courses are developed with support of the Fertiliser Association of New Zealand (FANZ) to provide students with the knowledge and

integrated skills necessary to produce industry-standard, farm-scale, Freshwater Farm Plans for dairy, beef and sheep and arable farms.



Mike Bretherton (Massey University) discussing the properties of the Tokomaru silt loam (poorly drained, Perch-gley Pallic soil) on the Tokomaru Marine Terrace in the Manawatū.

Reference:

Burkitt L and Bretherton M (2022) The importance of incorporating geology, soil, and landscape knowledge in freshwater farm planning in Aotearoa New Zealand. *Frontiers in Soil Science* 2:956692. doi: 10.3389/fsoil.2022.956692
<https://www.frontiersin.org/articles/10.3389/fsoil.2022.956692/full>

Massey Agriculture, Horticulture and Environmental Science Awards Night 2022.

Massey's School of Agriculture and Environment has named its top students of the year at their annual Agriculture, Horticulture and Environmental Science Awards Dinner.

The top six students from agricultural science, agribusiness, animal science, horticulture, earth and environmental sciences were announced, as over 250 people gathered at Palmerston North's Convention Centre for the 29th annual awards on Friday 21st of October 2022.

The awards bring together students, industry partners and educators to celebrate and reward excellence inside and outside of the classroom.

The first agricultural awards were in 1993. Each year since then, Massey has recognised and celebrated students who have made a positive impact on their peers and shown commitment to their study and research.

This year Massey celebrated Animal Science, Environment Science and Earth Science students, with three new awards for excellence going to the top student in each qualification.



Top students L-R: Adam Honeyfield (William Gerrish Memorial Award), Ingeborg Smythe (Earth Science), Joanna Wood (Environmental Science), Lachlan Barrett (Horticultural Science), Erika Lilley (Agriculture), Brooklynn Taylor (Animal Science) at the Massey Agriculture, Horticulture and Environmental Science Awards 2022.

Whenua Haumanu - Nurturing the land through exploring pastoral farming

The most comprehensive study of pastoral farming ever undertaken in New Zealand was launched by Agriculture Minister Hon Damien O'Connor on Friday 2nd September 2022 at Massey's Turitea Campus.

Led by Massey, with research partners AgResearch, Lincoln University, and Dairy Trust Taranaki, the \$26.12 million Whenua Haumanu programme will start in 2022 and continue for seven years. The Government is a key partner through its

Sustainable Food and Fibre Futures (SFF Futures) fund, which is administered by the Ministry for Primary Industries.

The research team will investigate multiple aspects of pastoral farming – from field to fork or pasture to plate. It stretches across the farm system, exploring from below the ground, through to animal product quality and food characteristics. Below ground measurements include investigations of soil biodiversity and microbial DNA, nutrient levels and losses, plant root growth, carbon cycling and storage, soil physical structure, earthworms and moisture levels. Above ground includes plant growth, quality and fermentation characteristics, persistence and health, greenhouse gas losses, animal production, reproduction and welfare, and the quality of animal products including meat, wool, milk and milk products.



Agriculture Minister Hon Damien O'Connor (fifth from left) paid a visit to the Manawatū campus to launch the programme

Pivot-funded Regenerative Agriculture project in Taranaki

Jointly funded by Bashford-Nicholls Trust and Massey University, the [Pivot Award](#) supports research initiatives with potential to influence the future of agriculture and to effect change in the Taranaki region.

“Measuring impacts of Regenerative Agriculture on Taranaki Farms” is being co-led by local Regen Ag leader Fiona Young and Eve Kawanna-Brown and Lucy Burkitt from Massey University. The co-designed and collaborative project is working closely with farmers in the Taranaki region, local Regen advisors (Cynthia Northcote), researchers and students from Massey (Jeya Jeyakumar and Rebekah Wood) and Auckland University of Technology (Syrie Hermans) and other

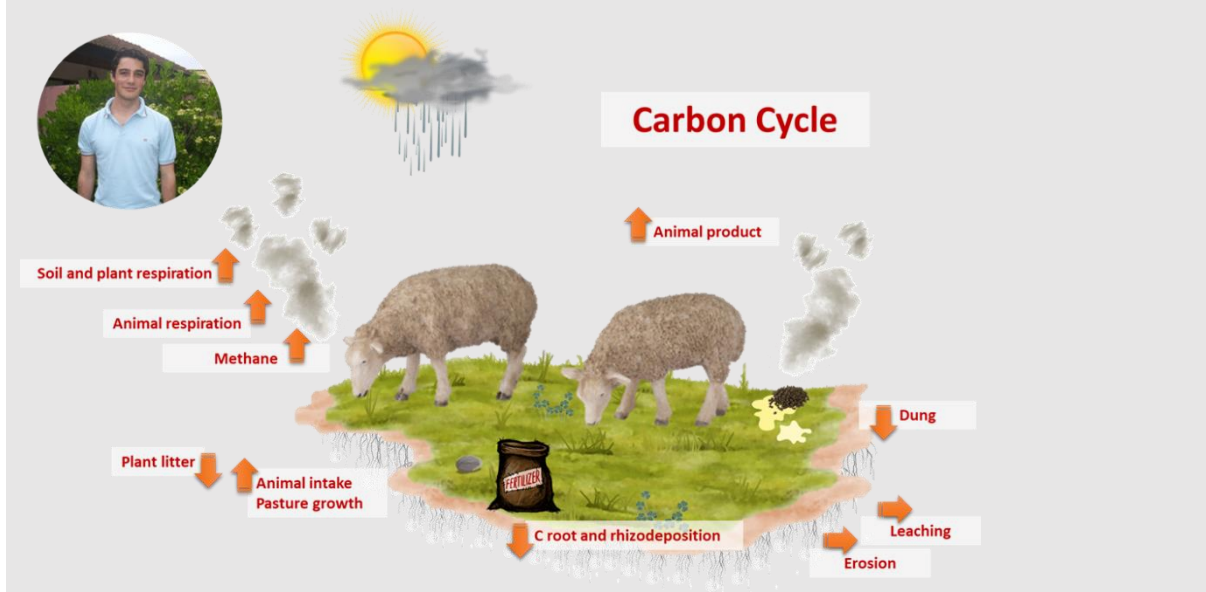
interested advisors, researchers and interest groups to develop a 'Regenerative Monitoring Framework'. Those involved have developed monitoring priorities, a framework and associated sampling protocols and indicators to monitor on-farm changes to soil health as well as to water, pastures, animal health and productivity and farmer wellbeing. The 'action' phase of the project kicked off in early November, with the first lot of on farm sampling and monitoring in the region.



Regen Ag leader Fiona Young, Taranaki farmer Brooke Laurence and Massey researcher Lucy Burkitt, sampling as part of the Pivot project.

AgResearch

Staff profile: Franco Bilotto



Born in Olavarria, Argentina, land of Gauchos and Paisanos, I grew up in a beef cattle farm helping my dad. In a different context, I find myself in New Zealand (Aotearoa), land shared by Kiwi and Maori, learning and helping to improve land use planning in sheep and beef cattle farms as part of larger team at AgResearch. My name is Franco Bilotto and I completed my PhD studies in Animal Science (Faculty of Veterinary Sciences - National University of the Center of Buenos Aires Province, Argentina) funded by CONICET (National Scientific and Technical Research Council) in 2020. The main objective of my PhD thesis was to explore potential sustainable pathways to intensify beef cattle systems in the Flooding Pampas, Argentina, identifying low-cost climate change adaptation and mitigation strategies. As part of a current international collaboration and ongoing learning process with researchers from The University of Tasmania and University of Melbourne, I am, as part of a second PhD, in a team including social research, biophysical, economic and GHG emissions modelling to examine cross-scale future climate change impacts and potential adaptations in the livestock sector (from paddock to regional/country scale). During the second half of 2018, I was awarded a LEARN (New Zealand Livestock Emissions Abatement Research Network) fellowship sponsored by the New Zealand Government, through the Ministry for Primary Industries (MPI) and New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC). The purpose of the scholarship was to build international capability in livestock emissions research. This outstanding experience gave me the opportunity to work with some of the most prominent scientists involved in pastoral GHG emissions and soils in New Zealand, Dr Alec Mackay (Principal Scientist) and Dr Ronaldo Vibart (Senior Scientist) from the Digital Agriculture-Land Function and Evaluation team at AgResearch Grasslands Research Centre. During that visit I extended the nutrient transfer model of Surinder Sagggar to include aspect in addition to slope, added carbon and nitrogen cycling, in addition to phosphorus and sulfur and also added a temporal element. Before arriving in NZ June, I had been working remotely from Argentina on the ecosystem model. My current work is on further developments of a soil phosphorus, carbon and nitrogen model in topographic diverse grasslands, by adding the influence of climate, the potential use of the model to assist in monitoring and also further analysis of the data emerging from the long-term P fertiliser and sheep grazing experiment at AgResearch Ballantrae Hill Country Research Station.

Canterbury and Otago

Lincoln Agritech

Critical Pathways Programme



Figure 1: Shallow groundwater sampling in the Piako catchment, November 2022.

As part of our Critical Pathways Programme, we have begun a shallow groundwater sampling campaign in the upper Piako study catchment this month. Our targeted approach uses inflatable packers to isolate discrete sections of the fully slotted screen (with no annular gap) with low flow pumping (up to 60 mL/min) to ensure representative samples of the shallow groundwater (up to 9 m depth). Samples are taken once field parameters (dissolved oxygen, pH, EC, temp) are stable and submitted for a range of analytes including nitrate.



Figure 2: Measuring temperature variation across a pool in the Wairau River using distributed temperature sensing (DTS).

Braided Rivers Programme

The Braided Rivers team have been busy doing temperature surveys in the Wairau catchment using a flexible (portable) fibre optic cable to see how river temperature distribution compares with thermal imagery from a NIWA drone. We have done several surveys across pools and riffles and found much greater variation than the thermal imagery, which just captures temperature at the river surface.

Doubling On-farm Diffuse Pollution Mitigation Programme

LAL and Land and Water Research Ltd (Greg Barkle), in close collaboration with the University of Waikato (Dorisel Torres-Rojas and Adam Hartland), just recently completed the experimental/sampling phase of an investigation to determine how modified woodchips enhance removal of nitrate and phosphorus from subsurface drainage water. As part of the Doubling On-farm Diffuse Pollution Mitigation programme being led by NIWA, the experiment used subsurface drainage water collected from a dairy farm in Tātuanui and thermally modified woodchips (biochar) functionalised with iron or manganese oxides. Laboratory analyses of samples are ongoing and results of the experiment are expected to provide options for enhancing the effectiveness of woodchip bioreactors as a tool for mitigating nutrient load to surface waters.



Figure 3: Lab-based bioreactor column experimental set-up. Each cylinder is filled with woodchips or a combination of woodchips and biochar with iron/manganese oxides.

DairyNZ Plantain Experiment

The Lincoln-based team have been kept busy this drainage season with record rainfall events occurring in Canterbury. Working as part of the team in DairyNZ lead Plantain Proficiency and Practice Programme with Lincoln University, experimental plots trialling plantain mixed with ryegrass have been established on a Lincoln University Research Dairy Farm. Soil water is collected using suction cups and analysed for various N species, and it is hoped that the plantain treatment will leach less nitrate, and produce urine with less nitrate to reduce on-farm leaching losses.



Figure 4: Lots of rain means lots of drainage and lots of prepping and sampling in the rain! Preparing suction cups for sampling the following day by applying a tension, July 2022.

Lincoln University

Manaaki Whenua - Landcare Research

Staff updates

After more than 35 years in public service - including at FRI - **John Payne** has retired from his research technician and workshop manager roles.

His abilities in constructing and installing field equipment were impressive and will be sorely missed. As will be his comments on politics and current affairs during morning tea.

In his last years at Lincoln office John has been meticulously working on compiling a hydrological legacy database, extracting and harmonising hydrological research data from 1975-2022. Please get in touch with us at soils@landcareresearch.co.nz if you are interested in exploring and using these data.



We congratulate **Kirstin Deuss** for successfully defending her PhD thesis, titled: 'A study of the soil pattern, properties and hydrology of a mole and tile-drained, loess-mantled downland in Southland, New Zealand'. The examiners noted that Kirstin's PhD was of an excellent standard, both in terms of the depth and breadth of the science, as well as the quality of the thesis writing and presentation.

Kirstin has joined Manaaki Whenua - Landcare Research as a pedologist in January and is currently working on the S-map expansion in the Marlborough region. If you want to learn more about Kirstin, you may also want to read the 'Early career researcher profile' section of the August 2022 Soil News.



A photo taken just minutes after Kirstin was awarded the PhD, together with the very happy supervisors and the PhD examiners. From left to right: Carol Smith, Kirstin Deuss, Peter Almond, Sam Carrick, David Horne, and Simeon Kaitibie.

Balin Robertson graduated from Lincoln University in September. His PhD thesis on 'The effect of rock fragments on the water retention properties of New Zealand stony soils' is now available from <https://researcharchive.lincoln.ac.nz/handle/10182/14484>

S-map Tasman expansion update

Tasman District Council (TDC) is funding MWLR to undertake soil mapping in 2020-2024 with a focus on productive land. Mapping is being conducted at a nominal scale of approximately 1:50,000. Existing data from 'legacy' soil surveys are being incorporated where available and suitable.

After some initial COVID-related delays good progress has been made over the last 12 months:

- Upper Takaka (1,685 ha): Field work completed by Gerard Grealish with support from Anne Wecking (TDC) and Iain Campbell. The map is currently under review and will be published on [S-map Online](#) in December 2022.
- Moutere Valley & Tasman (7,273 ha): Mapped by Thomas Caspari and Emily McKay with support from Anne Wecking (TDC). Field work is at advanced stage with map upload to S-map Online targeted for August 2023.
- Motueka & Riwaka (7,376 ha): Mapped by Andre Eger and Thomas Caspari. Field work is largely complete with map upload to S-map Online targeted for August 2023.
- Brightwater & Wakefield (7,252 ha): Mapped by Ian Lynn. Field work expected to start soon. Map upload to S-map Online planned for August 2023.
- Tapawera & Nearby Valleys (25,730 ha): Field survey will be started in 2023. Map upload to S-map Online planned for August 2024.



Anne Wecking (TDC) and Thomas Caspari (MWLR) on soil mapping duty in Moutere Valley. Photo: Anne Wecking.

More information on the project is available at <https://soils.landcareresearch.co.nz/smap-tasman>

Book review: 'In the beginning'

by Iain B. Campbell, 2021. ISBN 978-0-473-60605-3 374p.

Iain Campbell is a soil scientist, now living in Nelson, who worked for DSIR Soil Bureau through the 1960's, 70's and 80's, and then as an independent consultant for the last 34 years. He undertook soil mapping based in regional offices in Whanganui and

Nelson and was a pioneer of Antarctic Soil Science. "In the Beginning" is a personal memoir that takes the reader from his Dunedin childhood, in the 1930s depression, through university training at Canterbury, to Iain's professional career as a soil scientist, in which he is still active today, in his 80s. The book provides many anecdotes and some interesting history related to the era of major soil surveying effort that established much of our understanding of New Zealand Soils. The book also gives a chronological account of Iain's work in Antarctica, from the earliest pioneering days of soil studies, through to his recognition, in the late 1980s, of the need to improve understanding of the impacts of human activities on the Antarctic soil environment. The book also provides an entertaining account of Iain's personal and family life, and philosophy.

The writing is clear with excellent descriptions of the landscapes traversed. It gives an insight into an era of New Zealand history that only a few now have directly experienced. The tenor of hard work, and the miles walked and cycled, that pervaded Iain's childhood and youth are a timely reminder, in our increasingly sedentary lifestyle, of what humans are capable of, as well as the life of relative luxury that we all now enjoy.

Some important history of, both New Zealand and Antarctic, Soil Science is included in this account. The book also captures some of the excitement and adventure of a career in soil science with interesting anecdotes about Iain's work and travel in a range of places, including making pioneering contact with Russian cryosol researchers. Iain is still fondly remembered by Russian soil scientists. Photographs are generously scattered throughout, illustrating many interesting people, places, and activities.

Overall, I found the book to be an easy and entertaining read. I think it provides a valuable record of an important part of New Zealand Soil Science History. It is a great credit to Iain that he has completed this important account of a life, well lived, anchored in soil science. A copy may be obtained by emailing iaincampbell@xtra.co.nz

Megan Balks

Conflict of interest: I worked in Antarctica with Iain in the early 1990s and he was an important mentor to me, introducing me to Antarctic Soil Science, scientific publication, and the international Cryosol community, all of which have greatly enriched my life.

Audio visual

Soil and environmental related webinars and audio-visuals are presented below.

Podcast - Sam Carrick on Radio New Zealand 'The fragile magic of highly productive land'

<https://www.rnz.co.nz/programmes/the-detail/story/2018859977/the-fragile-magic-of-highly-productive-land>

News from the European Soil Data Centre

Second EUSO Stakeholders Forum (October 2022, online)

One year after the publication of the EU Soil Strategy and with the EU Soil Health Law in the pipeline, the European Commission confirms the growing recognition of the importance of healthy soils and their central role in tackling major societal challenges such as climate change, biodiversity decline and food security. Building on the EU Soil Strategy, the EU Soil Health Law is expected to include legally binding obligations to achieve healthy soils in the EU by 2050. In this context, the EU Soil Observatory (EUSO) convened its second Stakeholder Forum. Further details are available from: <https://esdac.jrc.ec.europa.eu/euso/second-euso-stakeholders-forum>

Global assessment of storm disaster-prone areas

Rainfall Erosivity Density is a measure of rainstorm aggressiveness and a proxy indicator of damaging hydrological events. By using measured Rainfall Erosivity Density for 3,625 rain gauges worldwide and applying kriging methodologies, we could identify the damaging hydrological hazard-prone areas that exceed warning and alert thresholds. Data available: <https://esdac.jrc.ec.europa.eu/content/global-rainfall-erosivity>

Abstracts

Earthworms for inclusion as an indicator of soil biological health in New Zealand pastures

Soil health encompasses the physical, chemical and biological components of the soil. In New Zealand, current officially recorded soil quality indicators do not include a biological indicator. Earthworms have long been recognised as useful indicators and as such offer an option for addressing the lack of a biological measure for on-farm assessment of soil health. In this paper we review the use of earthworms as indicators of soil health using both abundance and ecological group diversity. To use earthworms as an indicator of soil biological health, we recommend target earthworm abundances of $>400 \text{ ind./m}^2$, within which each of the three earthworm ecological groups (epigeic, endogeic and anecic) should be represented at a minimum of 25 ind./m^2 . When earthworm populations are at these target levels, the greatest benefits to soil functions can be realised. If earthworm populations are below target levels management practices can be appropriately altered to improve the soil environment and enhance their populations.

Schon NL, Fraser PM, Mackay AD 2022. Earthworms for inclusion as an indicator of soil biological health in New Zealand pastures. New Zealand Journal of Agricultural Research: 1-16

The state of knowledge of cadmium in New Zealand agricultural systems: 2021

Cadmium (Cd) has accumulated in New Zealand agricultural systems, predominantly from the application of phosphorus (P) fertiliser to soils. Elevated Cd concentrations in soils are an important issue due to their potential adverse effects on food quality, soil health, land use flexibility, and the environment. This paper reports on our current knowledge of Cd in New Zealand agricultural systems, summarising published and unpublished research that has been undertaken over the last 30 years to better understand, improve, and manage the potential adverse effects of Cd in agricultural soils. We found the research has been wide ranging, investigating factors such as Cd uptake in plants and animals, the rate of Cd inputs, transformation and losses from soils, Cd bioavailability, the development of animal uptake and Cd mass-balance models, as well as identifying and testing strategies and remediation options to manage Cd accumulation in agricultural systems. This research is then placed alongside the policy and regulatory context for managing Cd in agricultural systems in New Zealand, including national Cd management strategies. Finally, key knowledge gaps are presented, along with some potential Cd research directions for the future.

Gray CW, Cavanagh J-AE 2022. The state of knowledge of cadmium in New Zealand agricultural systems: 2021. *New Zealand Journal of Agricultural Research*: 1–51. <https://doi.org/10.1080/00288233.2022.2069130>

Priorities for soil science in Aotearoa New Zealand

Highlights:

- Local research is vital to for sustainable management of NZ's unique soil ecosystems.
- Soil-derived products are economically crucial to NZ (63% of export income in 2020).
- NZ soil research must focus on data and models for improved environmental management.
- Improved education and awareness of soils is vital for NZ to prosper.
- Soil state of environment reporting must continue with long term trials established.

Balks MR, Grealish G, Almond PC 2022. Priorities for soil science in Aotearoa New Zealand. *Geoderma Regional* 29: e00515.

Note: Priorities for soil science in a range of countries and Antarctica are published in this issue of Geoderma Regional,

<https://www.sciencedirect.com/journal/geoderma-regional/vol/29/suppl/C>

Fabrication and environmental applications of metal-containing solid waste/biochar composites: A review

The resource utilization of industrial solid waste has become a hot issue worldwide. Composites of biochar with metal-containing solid wastes (MCSWs)

cannot only improve the adsorption performance, but also reduce the cost of modification and promote the recycling of waste resources. Thus, the synthesis and applications of biochar composites modified by MCSWs have been attracting increasing attention. However, different MCSWs may result in metal-containing solid waste/biochar composites (MCSW-BCs) with various physicochemical properties and adsorption performance, causing distinct adsorption mechanisms and applications. Although a lot of research has been carried out, it is still in its infancy. In particular, the explanation on the adsorption mechanisms and influencing factors of pollutant onto MCSW-BCs are not comprehensive and clear enough. Therefore, a systematic review on fabrication and potential environmental applications of different MCSW-BCs is highly needed. Here we summarize the recent advances on the utilization of typical metal-containing solid wastes, preparation of MCSW-BCs, adsorption mechanisms and influencing factors of pollutants by MCSW-BCs as well as their environmental applications. Finally, comments and perspectives for future studies are proposed.

Ruohan Zhao, Bing Wang, Benny K.G. Theng, Pan Wu, Fang Liu, Xinqing Lee, Miao Chen, Jing Sun. *Science of the Total Environment* 799: 149295 (2021).

The importance of incorporating geology, soil, and landscape knowledge in freshwater farm planning in Aotearoa New Zealand

Over half of Aotearoa New Zealand's (NZ's) land area is under agriculture or forestry production. Long term monitoring has shown declines in freshwater quality in regions with the most intensive agriculture. The New Zealand government has historically focused on reducing the impact of agriculture on water quality through its Resource Management Act 1991. Lack of improvement in freshwater quality has resulted in the 2020 Essential Freshwater package of reforms which will require all pastoral farms >20 ha in size and all arable farms > 5 ha in size to develop a Freshwater Farm Plan (FFP) by a certified Freshwater Farm Planner. As far as we are aware, New Zealand is the first country in the world to mandate compulsory FFPs. This paper describes the key geological, soil, and landscape factors that need to be considered in an FFP for it to be successful in meeting the 2020 Essential Freshwater objectives. We argue that a greater emphasis should be placed on understanding a farm's natural resources, as they provide the physical interface between the farming system and both the freshwater and atmospheric ecosystems. Documenting our learning in this area could assist other countries considering Freshwater Farm Planning as a strategy to reduce the impact of agriculture on freshwater quality.

Burkitt L and Bretherton M (2022) The importance of incorporating geology, soil, and landscape knowledge in freshwater farm planning in Aotearoa New Zealand. *Frontiers in Soil Science* 2:956692. doi: 10.3389/fsoil.2022.956692
<https://www.frontiersin.org/articles/10.3389/fsoil.2022.956692/full>

Deadline..... for the February 2023 issue of Soil News is 13 February 2023

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